

37e 24

NEW and CORRECT  
**T A B L E S**  
OF THE  
**LUNAR MOTIONS,**  
ACCORDING TO THE  
**NEWTONIAN THEORY:**

As it is truly freed from all ERRORS of the PRESS.

Which TABLES are demonstratively prov'd to be true, by a sufficient Number of *Observations*, of the most Eminent *Astronomers* of this and the last AGE, viz. *Tycho Brahe*, *Longomontanus*, *Hevelius*, *Ricciolus*, *Bullialdus*, *Cassini*, *De la Hire*, *Dr. Halley*, *Mr. Flamsteed*, *Mr. Haynes*, &c. Being mostly *Observations* of *Lunar Eclipses*, and some of them taken by several of the aforesaid Observers at once. Together,

With the *Description* of a NEW INSTRUMENT for taking *Altitudes* at SEA, with much more Speed and Certainty than by any *Quadrant* yet invented; by Means of which INSTRUMENT (which may not improperly be call'd an *Hypsometer*) and the *Tables*, together with a *Book* lately printed, entitled, *An Humble Address to the Honourable Commissioners*, the LONGITUDE may be found, as often as shall be necessary, to the requir'd Exactness: As also, ECLIPSES may be calculated to the greatest Perfection.

The Whole design'd for the Use of,  
**His Royal Highness the DUKE of CUMBERLAND,**  
To whom with the greatest Submission it is most humbly dedicated.

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By **ROBERT WRIGHT**, B. A. Author of the Boook before mention'd; formerly of **JESUS COLLEGE in CAMBRIDGE.**

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N. B. These Books in *Quarto* bound up together, one for finding the *Moon's* Place by *Observation*, the other by *Calculation*, make a complete SYSTEM of all that is yet wanting in **NAVIGATION.**

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To the Most Serenè PRINCE  
WILLIAM AUGUSTUS,  
Duke of CUMBERLAND.

*May it please your Royal Highness,*

**H**AD not the Author been embolden'd to make this Address by the great Importance of the Subject treated upon in these Sheets, together with the vast and unknown Advantages thereof to the World in general, and more especially to this Nation in particular, whose great Honour and Happiness it is, that she can boast of giving Birth to such a bright and promising Genius, he had never run the hazard of disturbing or any way diverting Your Thoughts from Your other Studies, so happily directed by those learned Gentlemen, to whose Care the Forming of Your Princely Education is most wisely committed.

He humbly conceives it may be a Subject worthy of Your Princely regard, and which 'tis hoped may in due Time more nearly concern You, and that the Lord High Admiral of *Great Britain*, by the Discovery of the LONGITUDE, may as far surmount those of all other Nations in Nautical Skill, as She herself, who is justly term'd the Mistress of the Seas, does surpass Them in Naval Strength.

That it may please the Almighty long to preserve their Sacred MAJESTIES, His Royal Highness the Prince of WALES, His Royal Highness the Duke of CUMBERLAND, Their Royal Highnesses the PRINCESSES, and all the Royal Family, is the hearty Prayer of,

Your Royal Highness's

Most Devoted,

Most Obedient,

And, Most Humble Servant,

*Robert Wright.*

To the Most Gracious Prince  
WILLIAM ALBERT  
Duke of Cumberland

I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the proposed marriage of the Duke of Cumberland with the Princess of Wales. I am very glad to hear that the Duke of Cumberland is so highly respected and loved by his people. I am also very glad to hear that the Princess of Wales is so highly respected and loved by her people. I am sure that the marriage of the Duke of Cumberland with the Princess of Wales will be a very happy one and will be a great blessing to the people of Great Britain.

I am sure that the Duke of Cumberland will be a very good husband and a very good father. I am also sure that the Princess of Wales will be a very good wife and a very good mother. I am sure that the marriage of the Duke of Cumberland with the Princess of Wales will be a very happy one and will be a great blessing to the people of Great Britain. I am sure that the Duke of Cumberland will be a very good husband and a very good father. I am also sure that the Princess of Wales will be a very good wife and a very good mother.

I am sure that the Duke of Cumberland will be a very good husband and a very good father. I am also sure that the Princess of Wales will be a very good wife and a very good mother. I am sure that the marriage of the Duke of Cumberland with the Princess of Wales will be a very happy one and will be a great blessing to the people of Great Britain. I am sure that the Duke of Cumberland will be a very good husband and a very good father. I am also sure that the Princess of Wales will be a very good wife and a very good mother.





## THE INTRODUCTION.

**T**HE Author of this Scheme being upon full Consideration and repeated Observations well assured of it's being practicable and easie, as far as the Nature of the Thing can bear, and that, if Encouraged, it may be of general Use in Navigation, does therefore venture to submit it to publick Censure, not doubting, that notwithstanding whatever Objections envious and censorious Criticks may raise against it, as Envy is the Distemper of weak and mean Souls, yet those Honourable and Learned Judges, to whose Cognizance it properly belongs, will do it Justice.

He does not think it proper to trouble the Reader with a tedious and impertinent Preface concerning the Nature of the Longitude, and it's Usefulness, or the several ways that have been made use of, especially of late Years, towards it's Discovery, as being Things sufficiently known to all those who are chiefly concerned in the Practice and Application of such an Invention; neither to tell the World what were the Motives that induced him to apply himself to the Study thereof, or to make this his supposed Discovery publick. He does not utterly disclaim the Inducements of Self-Interest and Reputation, nor Sacrifice them wholly to the good of the Publick, as some others have done, if you will believe them; but fairly owns he had a View towards them all, which he thinks People will sooner believe and will easily excuse him for. He was not willing that these his Thoughts, which he takes to be true, as Men are apt to favour their own Opinions, should die with him, tho' he can still be content if they miscarry, with his usual Privacy and beloved Solitude: And perhaps it may be better for him, than by being too much Celebrated to run the Risque of sinking under such a Load, lest while he is contriving the Safety of others in the dangerous Ocean, by a sudden

Wast of aspiring Fortune he be Overfet himself. But prove that as it will; the Dice are thrown, and he must make the best of his Game; which (with the help of Providence) he hopes will be managed, if not to his Gain, yet not much to his Loss, altho' of Time, yet not of Reputation; since without Reflection, he has seen many as absurd Performances appear in Print upon the same Subject: To which therefore to come nearer it may not be improper to inform the Publick, that it was observ'd fifty Years ago by the present Famous Royal Astronomer the most sagacious and usefully Learned Dr. *H. Hey*, in the Preface and Appendix to his Catalogue of the Southern Stars, printed in the Year 1679, that if ever the Irregularities of the Moon's Motions were truly adjusted by Celestial Observations and a true physical Theory; and the places of the Stars rightly determin'd by the Observations of the great *Hevelius*, and those of Mr. *Flamsteed*; then a most exquisite Method wou'd be given of finding the Longitude of Places; both which by good Providence are now accomplished to the Satisfaction of the Learned, as will appear by the Testimonials of some of the most eminent Mathematicians and Astronomers of the Age. The late famous Astronomer Dr. *Gregory*, whose Book of Astronomy does sufficiently proclaim his worth, in the 33<sup>d</sup> Page thereof speaks thus of Sir *Isaac Newton's* Theory, viz. 'That most famous Philosopher has accomp'ish'd, what all Astronomers thought most difficult, and despaired of being perform'd, namely to determine the Moon's Place by Calculation, even in the Quadratures with the Sun, so exactly agreeing with the Heavens (as he has experienced by very many Places of the Moon observed by Mr. *Flamsteed*) that the disagreement therefrom, even when the greatest, scarce amounts to two first Minutes, and mostly is so small that it may deservedly be imputed to the uncertainty of Observation.' Thus far Dr. *Gregory*.

Another Testimonial is that of the famous Dr. *Halley*, in his Appendix to Mr. *Street's Astronomia Carolina*, 2d Edition, whose Words are these; I had intended to insist more largely upon this Method of obtaining the Moon's Place, and by Consequence the Longitude at Sea, but that I find it requires a just Treatise too long to be subjoin'd to this Appendix, and more especially that the Great Sir *Isaac Newton*, to whom no Mathematical Difficulty is Insuperable, has been pleas'd to give us a true and physical Theory of the Moon's Motions, whereby the Defects of all former Tables are so far amended, that 'tis hoped the Error may scarce ever exceed 3 Minutes in Motion, or so little in Longitude, that perhaps it may be thought



# The INTRODUCTION.

v.

‘ a sufficient Exactness for all the Uses of Navigation? Agreeable to this is that Elogium of the learned Mr. *Whiston* in his Astronomical Lectures, Page 344; who speaketh thus; ‘ Having now explain’d the Theory of the Planets, and brought our Astronomical Task to a Conclusion, We should forthwith proceed to the famous Sir *Isaac Newton*’s Philosophy, but that we are happily detain’d in the present place for a while by that celebrated Theory of the Moon, which that Prince of Geometricians and Astronomers hath very lately compos’d out of Mr. *Flamsteed*’s Observations, and Dr. *Gregory* hath communicated to the Publick; it being well worthy to be entertain’d and embraced by all Astronomers with the greatest Joy. For it is such a Theory, as when we spake of *Horrox*’s Hypothesis, we in vain wish’d for, while we expected it from none but him, from whom we now have it. And indeed it is a Theory, which the Author hath found so agreeing with the Heavens, that the disagreement therefrom in the Conjunctions with the Sun, and this when greatest, scarcely amounteth to more than two, and in the Quadratures scarcely to three Minutes, and for the most part it is so small, that it seems as it ought rather to be imputed to the uncertainty of Observation, than any thing else.

All these Encomiums from such great Men may be sufficient to make the World depend upon the Truth of this Theory. As to Mr. *Flamsteed*’s *Historia cœlestis Britannica*, lately publish’d, it may be thought needless to go about to defend it, his establish’d Character even amongst Foreigners being more than sufficient. However it may not be improper here to insert the Answer, that was sent to the Prince of *Denmark*’s Letter to the Royal Society, publish’d in the Preface to the First Volume of that Excellent Work, which is in *English* to this Effect, ‘ This Series of Observations we look upon to be the most Copious and Perfect of any, that was ever yet made, and as it contributes very much to the Perfection both of Astronomy and Navigation, so if it should be lost, we think that loss can never be repaired. But how such an expensive Work should ever be publish’d, we cannot at all imagine, unless Your Highness will be pleas’d to do it at Your own Charge’. Thus testifie,

Your Highness’s,

most humbly devoted Servants,

*Francis Roberts.* } *Isaac Newton.* } *John Arbuthnot.*  
*Christopher Wren.* } *David Gregory.* }

As

As to the so much celebrated Theory of the incomparable Sir *Isaac Newton*, it is that I have closely adher'd to in the following Tables and Observations, unless where a manifest Inconsistency, occasion'd by the Errors of the Press, have oblig'd me to deviate from it. I remember indeed a certain learned Gentleman of the Royal Society, told me, I follow'd Sir *Isaac*, too superstitiously; so He was pleas'd to express it. This Charge, (if it be a Fault) with a grateful Regard to the Memory of that wonderful great Man, I freely own and heartily espouse, since He was the First, that ever knew any thing of the true and physical Reason of the Cœlestial Motions, and of the various seeming Irregularities of the Moon, arising from different Attractions; so that I could not abate any one of his Equations, which by examining the Observations and the Solution of them will appear to be all necessary. If therefore, by the following Tables the Moon's Place in her Orbit may be found at any time sufficiently near for the Meridian of *Greenwich*; and if by the five Methods in the other Book, which are all demonstrably true, the Moon's Place may be found by Observation, by the Use of such an Instrument as I shall now describe; then will the Art of Navigation, by the Use of these two Books and this Instrument, be improved to the utmost Perfection.

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### *A Description of the Hypsometer.*

**T**HIS Instrument consists chiefly of two Wheels, moved by two perpetual Screws within a Case of six Inches square; to which is affix'd on the Right Side a Square Plate with a Circle upon it, like the Face of a Clock. This Circle being 12 Inches in Diameter, is divided into 100 equal Parts. There is a Handle or Key like that which winds up a Clock, only with this difference, that, whereas in that the Handle is at the End of the Shaft, this is in the Middle of it, and the End, which reaches to the Divisions on the Circle is made sharp to shew the Divisions more exactly. The Handle being put upon the Square End of a perpetual Screw, by turning about moves a Wheel of 48 Teeth, placed horizontally. Upon the Spindle of this Wheel is another perpetual Screw, which moves another Wheel placed perpendicular, of 45 Teeth. The End of the Spindle of this Wheel comes through the Left Side of the Case. The turning about of the Handle elevates a short Telescope of 35 Inches in length. The  
Object



Object Glass whereof hath an Aperture of  $0\ 85$  Parts of an Inch, and it's Focal Distance or Radius is just 30 Inches. In the Focus whereof, or at 30 Inches Distance from the Glass, is fixed horizontally, a very slender Wire, and near it, towards the Eye, there is an Opening in the Side of the Tube, made sloping to give a Light to the Wire in dark Nights. At 31 Inches from the Glass is placed another Convex Glass, at 33 Inches a 2d, and at 35 a 3d, all three having the Radius or Focal distance of an Inch; so that the apparent Diameter of the Sun or Moon is magnified just 30 Times. The Middle of the Tube is bound fast about with a Brass Hoop an Inch broad, from which proceeds a Socket an Inch long, and half an Inch wide within. This Socket in time of Use is put upon the End of the Spindle of the perpendicular Wheel of 45 Teeth, (which comes through the Left Side of the Case) and fastned to it with a Screw. The Handle turn'd once about elevates the Tube ten Minutes of a Degree, three Times raises it 30 Minutes, being about the Compass of the Sun or Moon, 6 times raises it a Degree, and so on. Now 8 times 6 making 48, by that time the Horizontal Wheel is turn'd once about, the Tube will be raised 8 Degrees, and 8 times 45 making 360, by that time the Wheel of 45 Teeth were turn'd once about, the Tube would be moved quite round. But there is no need of any Thing like this; for raising it 2 or 3 Degrees is sufficient, and therefore there need not to be cut above 12 Teeth for 2 Degrees, and 18 for 3 in the 48 Wheel, and not above 2 or 3 in that of 45 Teeth, as will appear by what follows.

To come therefore to the Use of this Instrument; When an Altitude is to be taken, first take it as near as can be by a Quadrant of 6 or 8 Inches Radius, which may be done within a Degree or two, as suppose I find the Altitude of a Star or of the Moon's higher Limb to be 40 Degrees or thereabouts; by a well divided Quadrant of about a Foot Radius, I set a Bevel to an Angle of 39 Degrees, if the Altitude be increasing, because some Time will be taken up in preparing for the Observation; but if decreasing, to 38. There proceeds from the Center of the Instrument or may be affixed to it, when used, an Horizontal Piece of about a Foot long, on which is drawn an Horizontal Line from the Center. The Bevel therefore being fix'd to an Angle of 39 or 38 Degrees, let one Side of it be applied exactly to the said Line, and let the Socket be turn'd on the end of the Spindle, till the Tube (which must truly be Cylindrical) touch the other Side. Then having turn'd the Handle back to the beginning of the Divisions

ons on the Circle, which is, when it can be turn'd no farther, there being no Teeth cut, screw the Socket fast to the Spindle; so is it ready for the Observation. But still there is required another Addition, viz. a Staff of about a Man's height and about 3 or 4 Inches Square; within this Staff or on the back of it is to slide a Piece of about an Inch Square, whereon is put a Line of Sines to the Radius of 17. 5 Inches, such as this in the Margin. The top of this Piece at the time of Observation is to be screw'd fast to the

| Deg. | In. 100 |
|------|---------|
| 5    | 1.53    |
| 10   | 3.04    |
| 15   | 4.53    |
| 20   | 6.00    |
| 25   | 7.40    |
| 30   | 8.75    |
| 35   | 10.04   |
| 40   | 11.25   |
| 45   | 12.37   |
| 50   | 13.41   |
| 55   | 14.34   |
| 60   | 15.16   |
| 65   | 15.86   |
| 70   | 16.44   |
| 75   | 16.91   |
| 80   | 17.24   |
| 85   | 17.44   |
| 90   | 17.50   |

Cafe of the Instrument, and the Piece rais'd or depress'd by means of the Line of Sines, as the Altitude requires. For Instance; If the Object be 5 Degrees high, the Piece must be rais'd 1 Inch and 53 Hundredth Parts, if 20 Degrees high just 6 Inches, and so for the rest: Now 'tis but measuring 1 53 from a Decimal Rule, and there placing 5 Degrees; and measuring out 3. 04, and there placing 10 Degrees, and so on, and raising the Piece to those Degrees; so the Tube will be rais'd to the height of the Eye. Otherwise when the Altitude is great, the Eye-Glass would be depress'd so low, that the Observer must be forced to stoop, but by this means he always keeps his natural upright Posture, and has nothing to do, but to turn about the Key, and look through the Tube, only he may when there is Occasion, hold a Lanthorn with his left Hand to the opening of the Tube, and so give Light to the Wire. There must be two Handles put to the Staff, and a Spirit Level about Breast high fix'd to it with a Cafe of Glass on the Side, and something above to put a

Candle in, and so to give Light to the Level. There must be an Assistant, whose only Business is to hold the Staff by the two Handles, and, as the Ship rolls, to recover the Staff to be truly Perpendicular by the help of the Level, which certainly must be practicable at Sea, or no Instrument can. The Observer turns the Handle leisurely about, especially when he comes near the Object, till the Horizontal Wire cut the Star, or the Center or Limb of the Sun or Moon, and then stopping his Hand observe the Division on the Circle, where the sharp end of the Handle rests, which Handle has a Spring, by means of which, it moves not, but keeps steady to the Place it first rests at. Now the Counting is very easie; for if the Observer but remembers the



the number of Turns he cannot be mistaken, since six Turns raise the Tube one Degree, every single Turn 10 Minutes, and the Circle being divided into 100 Parts, every tenth Division is a Minute, every fifth half a Minute, or 30 Seconds, and every Division six Seconds, which the Eye may easily divide into 3 parts of 2 Seconds each. Now that two Seconds may as well be distinguish'd on the magnified Diameter of the Sun or Moon, is evident; for whereas there are 3600 Seconds in a Degree, and 1800 in a half; if there be 900 distinguishable parts in their Diameter magnified 30 times, then what was said before is true. Now there being 30 Minutes in their Diameter or thereabouts, this Squared or Multiplied by 30 produces 900. Their Diameter even in their Apogee appears full as big; as that of a Circle of 30 Inches does at the distance of three or four Foot. Now if any one at this distance should look at a white Circle of 30 Inches Diameter, he might with a Hair or very slender Wire held Horizontally easily distinguish Inches, I may say half Inches, that is, in the Sun or Moon Seconds, nay Quarters or half Seconds, as any one may try by so looking at a Yard-Rod divided into Inches.

To take the Altitude of the Sun there is affix'd to the Tube a smoked Glass betwixt the Eye-Glass and the Eye. Or there may instead thereof be erected a perpendicular Plate of Brass to take the Image of the Sun. The Spirit Level had best be made in the form of a Cross, one end of which may go through the Staff, and when the Bubble of Air is just in the middle of the Cross, the Staff will be truly Perpendicular, inclining neither to the Right nor Left, forwards nor backwards, provided it be truly made; otherwise it must be corrected by Experience. If the Spirits be colour'd with Dragon's Blood, the Bubble will be more easily distinguished.

This Instrument may be applied to a Post erected perpendicular in a Garden, and by means of a Socket may be turned to any Azimuth, as I have one in mine, which moves forwards or backwards most equably and truly without the least Jogging, made by a very ingenious Workman (*Thomas Clark in Warrington*) by whom any Gentleman may be accommodated to Satisfaction. It shews the Altitude full as exactly, and with a great deal more Speed and less Expence, than the best Quadrant of 6 Foot Radius can do. There must be two of these Instruments one to take the height of the Moon, and another that of the Sun, or of a fix'd Star, as near as may be at the same time. Whethersoever of them takes the Observation first, let  

B

him

him call to have the Half-minute Glass turn'd, and when the other has done, let him order it to be stopp'd. By having the Altitude of the Sun or a known Star the Hour may be found, supposing the Latitude known, and if to or from this be added or subtracted the Difference of time between the Observations, the time of the Moon's observed Altitude will be had, and by the second Method in the other Book, the Moon's Place in her Orbit may be found; and by the following Tables it may be Calculated, what a Clock it was at the Royal Observatory at *Greenwich*, when the Observation was made, and so the Longitude of the Place may also be found. Whereas it was said a little before (supposing the Latitude known) I shall take this Opportunity of shewing some other ways of finding the Latitude besides the common one by the Sun's Meridian Altitude. As first, when two Stars that have the same right Ascension (of which the Reader may find a Catalogue in the other Book, viz. *An humble Address, &c.*) come into the same Azimuth, by taking the Altitude of either and allowing for Refraction, as must always be done, having their Declination given, he may find the Latitude, and having their right Ascension he may know the Hour, as by Method the first in the other Book. A second way is described in the fifth Method, so I shall say no more of it here. A third way is; at the Rising or Setting of the Sun, which is, when the lower Limb is apparently above the Horizon by half the Diameter, let the Amplitude be carefully observed by a large and truly divided Azimuth Compass; then if the Variation be known, which alters but little in a considerable distance of Place the Latitude may be found by the Triangle  $P \odot O$  in Fig. 4th, where  $\odot O$  the Complement of the Amplitude and  $\odot P$  the Complement of the Declination being given, and  $\odot O P$  a right Angle, the Side  $P O$  may be found, which gives the Latitude. When I speak of the Sun's declination being given, I do not mean so given, as by the Tables of his Declination, which it is not sufficient to go by, but having his Place given in the Ecliptic by some true Ephemeris or found by these Tables, let the Declination be found not only for Noon, but any other time of the Day: For without due Care and Exactness it will be in Vain to seek for the Longitude. If the Variation be not known nor the Latitude, let this be found by the Sun's Meridian Altitude; afterwards let the Sun's Altitude and magnetical Azimuth be both observed at the same time; then the Latitude, the Sun's Declination and Altitude being given, his true Azimuth may be found, and so the variation of the Compass. If this be known, another



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another way of finding the Latitude any time of the Day will be thus; Let the Sun's Altitude and Azimuth be both observed; so having the Sun's Altitude, his Azimuth and Declination given, the Latitude may be found, and also the true time of the Day.

Having thus given the Reader several ways of finding the Latitude, which should be done frequently, and also fully described the Instrument, I shall now proceed to the Tables, and shall begin with that of Logistical Logarithms (as being of Use in all the rest) which here follows.

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The

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# xii. The TABLE of Logistical Logarithms.

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6    | 7    | 8    | 9    |
|----|-------|-------|-------|-------|-------|-------|------|------|------|------|
|    | 0     | 60    | 120   | 180   | 240   | 300   | 360  | 420  | 480  | 540  |
| 01 | 17782 | 14771 | 13010 | 11761 | 10792 | 10000 | 9331 | 8751 | 8239 |      |
| 1  | 35563 | 17710 | 14735 | 12986 | 11743 | 10777 | 9988 | 9320 | 8742 | 8231 |
| 2  | 32553 | 17639 | 14699 | 12962 | 11725 | 10763 | 9976 | 9310 | 8733 | 8223 |
| 3  | 30792 | 17570 | 14664 | 12939 | 11707 | 10749 | 9964 | 9300 | 8724 | 8215 |
| 4  | 29542 | 17501 | 14629 | 12915 | 11689 | 10734 | 9952 | 9289 | 8715 | 8207 |
| 5  | 28573 | 17434 | 14594 | 12891 | 11671 | 10720 | 9940 | 9279 | 8706 | 8199 |
| 6  | 27782 | 17368 | 14559 | 12868 | 11654 | 10706 | 9928 | 9269 | 8697 | 8191 |
| 7  | 27112 | 17302 | 14525 | 12845 | 11636 | 10692 | 9916 | 9259 | 8688 | 8183 |
| 8  | 26532 | 17238 | 14491 | 12821 | 11619 | 10678 | 9905 | 9249 | 8679 | 8175 |
| 9  | 26021 | 17175 | 14457 | 12798 | 11601 | 10663 | 9893 | 9238 | 8670 | 8167 |
| 10 | 25563 | 17112 | 14424 | 12775 | 11584 | 10649 | 9881 | 9228 | 8661 | 8159 |
| 11 | 25149 | 17050 | 14390 | 12753 | 11566 | 10635 | 9869 | 9218 | 8652 | 8152 |
| 12 | 24771 | 16990 | 14357 | 12730 | 11549 | 10621 | 9858 | 9208 | 8643 | 8144 |
| 13 | 24424 | 16930 | 14325 | 12707 | 11532 | 10608 | 9846 | 9198 | 8635 | 8136 |
| 14 | 24102 | 16871 | 14292 | 12685 | 11515 | 10594 | 9834 | 9188 | 8626 | 8128 |
| 15 | 23802 | 16812 | 14260 | 12663 | 11498 | 10580 | 9823 | 9178 | 8617 | 8120 |
| 16 | 23522 | 16755 | 14228 | 12640 | 11481 | 10566 | 9811 | 9168 | 8608 | 8112 |
| 17 | 23259 | 16698 | 14196 | 12618 | 11464 | 10552 | 9800 | 9158 | 8599 | 8104 |
| 18 | 23010 | 16642 | 14165 | 12596 | 11447 | 10539 | 9788 | 9148 | 8591 | 8097 |
| 19 | 22775 | 16587 | 14133 | 12574 | 11430 | 10525 | 9777 | 9138 | 8582 | 8089 |
| 20 | 22553 | 16532 | 14102 | 12553 | 11413 | 10512 | 9765 | 9128 | 8573 | 8081 |
| 21 | 22341 | 16478 | 14071 | 12531 | 11397 | 10498 | 9754 | 9119 | 8565 | 8073 |
| 22 | 22139 | 16425 | 14042 | 12510 | 11380 | 10484 | 9742 | 9109 | 8556 | 8066 |
| 23 | 21946 | 16372 | 14010 | 12488 | 11363 | 10471 | 9731 | 9099 | 8547 | 8058 |
| 24 | 21761 | 16320 | 13979 | 12467 | 11347 | 10458 | 9720 | 9089 | 8539 | 8050 |
| 25 | 21584 | 16269 | 13949 | 12445 | 11331 | 10444 | 9708 | 9079 | 8530 | 8043 |
| 26 | 21413 | 16218 | 13919 | 12424 | 11314 | 10431 | 9697 | 9070 | 8522 | 8035 |
| 27 | 21249 | 16168 | 13890 | 12403 | 11298 | 10418 | 9686 | 9060 | 8513 | 8027 |
| 28 | 21091 | 16118 | 13860 | 12382 | 11282 | 10404 | 9675 | 9050 | 8504 | 8020 |
| 29 | 20939 | 16069 | 13831 | 12362 | 11266 | 10391 | 9664 | 9041 | 8496 | 8012 |
| 30 | 20792 | 16021 | 13802 | 12341 | 11249 | 10378 | 9652 | 9031 | 8487 | 8004 |



# The TABLE of Logistical Logarithms.

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|    | 0     | 1     | 2     | 3     | 4     | 5     | 6    | 7    | 8    | 9    |
|----|-------|-------|-------|-------|-------|-------|------|------|------|------|
|    | 0     | 60    | 120   | 180   | 240   | 300   | 360  | 420  | 480  | 540  |
| 30 | 20792 | 16021 | 13802 | 12341 | 11249 | 10378 | 9652 | 9031 | 8487 | 8004 |
| 31 | 20649 | 15973 | 13773 | 12320 | 11233 | 10365 | 9641 | 9021 | 8479 | 7997 |
| 32 | 20512 | 15925 | 13745 | 12300 | 11217 | 10352 | 9630 | 9012 | 8470 | 7989 |
| 33 | 20378 | 15878 | 13716 | 12279 | 11201 | 10339 | 9619 | 9002 | 8462 | 7981 |
| 34 | 20248 | 15832 | 13688 | 12259 | 11186 | 10326 | 9608 | 8992 | 8453 | 7974 |
| 35 | 20122 | 15786 | 13660 | 12239 | 11170 | 10313 | 9597 | 8983 | 8445 | 7966 |
| 36 | 20000 | 14740 | 13632 | 12218 | 11154 | 10300 | 9586 | 8973 | 8437 | 7959 |
| 37 | 19881 | 15695 | 13604 | 12198 | 11138 | 10287 | 9575 | 8964 | 8428 | 7951 |
| 38 | 19765 | 15651 | 13576 | 12178 | 11123 | 10274 | 9564 | 8954 | 8420 | 7944 |
| 39 | 19652 | 15607 | 13549 | 12159 | 11107 | 10261 | 9553 | 8945 | 8411 | 7936 |
| 40 | 19542 | 15563 | 13522 | 12139 | 11091 | 10248 | 9542 | 8935 | 8403 | 7929 |
| 41 | 19435 | 15520 | 13495 | 12119 | 11076 | 10235 | 9532 | 8926 | 8395 | 7921 |
| 42 | 19331 | 15477 | 13468 | 12099 | 11061 | 10223 | 9521 | 8917 | 8386 | 7914 |
| 43 | 19228 | 15435 | 13441 | 12080 | 11045 | 10210 | 9510 | 8907 | 8378 | 7906 |
| 44 | 19128 | 15393 | 13415 | 12061 | 11030 | 10197 | 9499 | 8898 | 8370 | 7899 |
| 45 | 19031 | 15351 | 13388 | 12041 | 11015 | 10185 | 9488 | 8888 | 8361 | 7891 |
| 46 | 18935 | 15310 | 13362 | 12022 | 10999 | 10172 | 9478 | 8879 | 8353 | 7884 |
| 47 | 18842 | 15269 | 13336 | 12003 | 10984 | 10160 | 9467 | 8870 | 8345 | 7877 |
| 48 | 18751 | 15229 | 13310 | 11984 | 10969 | 10147 | 9456 | 8861 | 8337 | 7869 |
| 49 | 18661 | 15189 | 13284 | 11965 | 10954 | 10135 | 9446 | 8851 | 8328 | 7862 |
| 50 | 18573 | 15149 | 13259 | 11946 | 10939 | 10122 | 9435 | 8842 | 8320 | 7855 |
| 51 | 18487 | 15110 | 13233 | 11927 | 10924 | 10110 | 9425 | 8833 | 8312 | 7847 |
| 52 | 18403 | 15071 | 13208 | 11908 | 10909 | 10098 | 9414 | 8824 | 8304 | 7840 |
| 53 | 18320 | 15032 | 13183 | 11889 | 10894 | 10085 | 9404 | 8814 | 8296 | 7832 |
| 54 | 18229 | 14994 | 13158 | 11871 | 10880 | 10073 | 9393 | 8805 | 8288 | 7825 |
| 55 | 18159 | 14956 | 13133 | 11852 | 10865 | 10061 | 9383 | 8796 | 8279 | 7818 |
| 56 | 18081 | 14918 | 13108 | 11834 | 10850 | 10049 | 9372 | 8787 | 8271 | 7811 |
| 57 | 18004 | 14881 | 13083 | 21816 | 10835 | 10036 | 9362 | 8778 | 8263 | 7803 |
| 58 | 17929 | 14844 | 13059 | 11797 | 10821 | 10024 | 9351 | 8769 | 8255 | 7796 |
| 59 | 17855 | 14808 | 13034 | 11779 | 10806 | 10012 | 9341 | 8760 | 8247 | 7789 |
| 60 | 17782 | 14771 | 13010 | 11761 | 10792 | 10000 | 9331 | 8751 | 8239 | 7782 |

The

# 14 The TABLE of Logistical Logarithms.

|    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   | 20   | 21   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|
|    | 600  | 660  | 720  | 780  | 840  | 900  | 960  | 1020 | 1080 | 1140 | 1200 | 1260 |
| 0  | 7782 | 7368 | 6990 | 6642 | 6320 | 6021 | 5740 | 5477 | 5229 | 4994 | 4771 | 4559 |
| 1  | 7774 | 7361 | 6984 | 6637 | 6315 | 6016 | 5736 | 5473 | 5225 | 4990 | 4768 | 4556 |
| 2  | 7767 | 7354 | 6978 | 6631 | 6310 | 6011 | 5731 | 5469 | 5221 | 4986 | 4764 | 4552 |
| 3  | 7760 | 7348 | 6972 | 6625 | 6305 | 6006 | 5727 | 5464 | 5217 | 4983 | 4760 | 4549 |
| 4  | 7753 | 7341 | 6966 | 6620 | 6300 | 6001 | 5722 | 5460 | 5213 | 4979 | 4757 | 4546 |
| 5  | 7745 | 7335 | 6960 | 6614 | 6294 | 5997 | 5718 | 5456 | 5209 | 4975 | 4753 | 4542 |
| 6  | 7738 | 7328 | 6954 | 6609 | 6289 | 5992 | 5713 | 5452 | 5205 | 4971 | 4750 | 4539 |
| 7  | 7731 | 7322 | 6948 | 6603 | 6284 | 5987 | 5709 | 5447 | 5201 | 4967 | 4746 | 4535 |
| 8  | 7724 | 7315 | 6942 | 6598 | 6279 | 5982 | 5704 | 5443 | 5197 | 4964 | 4742 | 4532 |
| 9  | 7717 | 7309 | 6936 | 6592 | 6274 | 5977 | 5700 | 5439 | 5193 | 4960 | 4739 | 4528 |
| 10 | 7710 | 7302 | 6930 | 6587 | 6269 | 5973 | 5695 | 5435 | 5189 | 4956 | 4735 | 4525 |
| 11 | 7703 | 7296 | 6924 | 6581 | 6264 | 5968 | 5691 | 5430 | 5185 | 4952 | 4732 | 4522 |
| 12 | 7696 | 7289 | 6918 | 6576 | 6259 | 5963 | 5686 | 5426 | 5181 | 4949 | 4728 | 4518 |
| 13 | 7688 | 7283 | 6912 | 6570 | 6254 | 5958 | 5682 | 5422 | 5177 | 4945 | 4724 | 4515 |
| 14 | 7681 | 7276 | 6906 | 6565 | 6248 | 5954 | 5677 | 5418 | 5173 | 4941 | 4721 | 4511 |
| 15 | 7674 | 7270 | 6900 | 6559 | 6243 | 5949 | 5673 | 5414 | 5169 | 4937 | 4717 | 4508 |
| 16 | 7667 | 7264 | 6894 | 6554 | 6238 | 5944 | 5669 | 5409 | 5165 | 4933 | 4714 | 4505 |
| 17 | 7660 | 7257 | 6888 | 6548 | 6233 | 5939 | 5664 | 5405 | 5161 | 4930 | 4710 | 4501 |
| 18 | 7653 | 7251 | 6882 | 6543 | 6228 | 5935 | 5660 | 5401 | 5157 | 4926 | 4707 | 4498 |
| 19 | 7646 | 7244 | 6877 | 6538 | 6223 | 5930 | 5655 | 5397 | 5153 | 4922 | 4703 | 4494 |
| 20 | 7639 | 7238 | 6871 | 6532 | 6218 | 5925 | 5651 | 5393 | 5149 | 4918 | 4699 | 4491 |
| 21 | 7632 | 7232 | 6865 | 6527 | 6213 | 5920 | 5646 | 5389 | 5145 | 4915 | 4696 | 4488 |
| 22 | 7625 | 7225 | 6859 | 6521 | 6208 | 5916 | 5642 | 5384 | 5141 | 4911 | 4692 | 4484 |
| 23 | 7618 | 7219 | 6853 | 6516 | 6203 | 5911 | 5637 | 5380 | 5137 | 4907 | 4689 | 4481 |
| 24 | 7611 | 7212 | 6847 | 6510 | 6198 | 5906 | 5633 | 5376 | 5133 | 4903 | 4685 | 4477 |
| 25 | 7604 | 7206 | 6841 | 6505 | 6193 | 5902 | 5629 | 5372 | 5129 | 4900 | 4682 | 4474 |
| 26 | 7597 | 7200 | 6836 | 6500 | 6188 | 5897 | 5624 | 5368 | 5125 | 4896 | 4678 | 4471 |
| 27 | 7590 | 7193 | 6830 | 6494 | 6183 | 5892 | 5620 | 5364 | 5122 | 4892 | 4675 | 4467 |
| 28 | 7583 | 7187 | 6824 | 6489 | 6178 | 5888 | 5615 | 5359 | 5118 | 4889 | 4671 | 4463 |
| 29 | 7577 | 7181 | 6819 | 6484 | 6173 | 5883 | 5611 | 5355 | 5114 | 4885 | 4668 | 4460 |
| 30 | 7570 | 7175 | 6812 | 6478 | 6168 | 5878 | 5607 | 5351 | 5110 | 4881 | 4664 | 4457 |



# The TABLE of Logistical Logarithms. 15

|    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   | 20   | 21   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|
| "  | 600  | 660  | 720  | 780  | 840  | 900  | 960  | 1020 | 1080 | 1140 | 1200 | 1260 |
| 30 | 7570 | 7175 | 6812 | 6478 | 6168 | 5878 | 5607 | 5351 | 5110 | 4881 | 4664 | 4457 |
| 31 | 7563 | 7168 | 6807 | 6473 | 6163 | 5874 | 5602 | 5347 | 5106 | 4877 | 4660 | 4454 |
| 32 | 7556 | 7162 | 6801 | 6467 | 6158 | 5869 | 5598 | 5343 | 5103 | 4874 | 4657 | 4450 |
| 33 | 7549 | 7156 | 6795 | 6462 | 6153 | 5864 | 5594 | 5339 | 5098 | 4870 | 4653 | 4447 |
| 34 | 7242 | 7149 | 6789 | 6457 | 6148 | 5860 | 5589 | 5335 | 5094 | 4866 | 4650 | 4444 |
| 35 | 7535 | 7143 | 6784 | 6451 | 6143 | 5855 | 5585 | 5331 | 5090 | 4863 | 4646 | 4440 |
| 36 | 7528 | 7137 | 6778 | 6446 | 6138 | 5850 | 5580 | 5326 | 5086 | 4859 | 4643 | 4437 |
| 37 | 7522 | 7131 | 6772 | 6441 | 6133 | 5846 | 5576 | 5322 | 5082 | 4855 | 4639 | 4434 |
| 38 | 7515 | 7124 | 6766 | 6435 | 6128 | 5841 | 5572 | 5318 | 5079 | 4852 | 4636 | 4430 |
| 39 | 7508 | 7118 | 6761 | 6430 | 6113 | 5836 | 5567 | 5314 | 5075 | 4848 | 4632 | 4427 |
| 40 | 7510 | 7112 | 6755 | 6425 | 6118 | 5832 | 5563 | 5310 | 5071 | 4844 | 4629 | 4424 |
| 41 | 7494 | 7106 | 6749 | 6420 | 6123 | 5827 | 5559 | 5306 | 5067 | 4841 | 4625 | 4420 |
| 42 | 7488 | 7100 | 6743 | 6414 | 6108 | 5823 | 5554 | 5302 | 5063 | 4837 | 4622 | 4417 |
| 43 | 7481 | 7093 | 6738 | 6409 | 6103 | 5818 | 5550 | 5298 | 5059 | 4833 | 4618 | 4414 |
| 44 | 7474 | 7087 | 6732 | 6404 | 6099 | 5813 | 5546 | 5294 | 5055 | 4830 | 4615 | 4410 |
| 45 | 7467 | 7081 | 6726 | 6398 | 6094 | 5809 | 5541 | 5290 | 5051 | 4826 | 4611 | 4407 |
| 46 | 7461 | 7075 | 6721 | 6393 | 6089 | 5804 | 5537 | 5285 | 5048 | 4822 | 4608 | 4404 |
| 47 | 7454 | 7069 | 6715 | 6388 | 6084 | 5800 | 5533 | 5281 | 5044 | 4819 | 4604 | 4400 |
| 48 | 7447 | 7063 | 6709 | 6383 | 6079 | 5795 | 5528 | 5277 | 5040 | 4815 | 4601 | 4397 |
| 49 | 7441 | 7057 | 6704 | 6377 | 6074 | 5790 | 5524 | 5273 | 5036 | 4811 | 4597 | 4394 |
| 50 | 7434 | 7050 | 6698 | 6372 | 6069 | 5786 | 5520 | 5269 | 5032 | 4808 | 4594 | 4390 |
| 51 | 7427 | 7044 | 6692 | 6367 | 6064 | 5781 | 5516 | 5265 | 5028 | 4804 | 4590 | 4387 |
| 52 | 7421 | 7038 | 6687 | 6362 | 6059 | 5777 | 5511 | 5261 | 5025 | 4800 | 4587 | 4384 |
| 53 | 7414 | 7032 | 6681 | 6357 | 6055 | 5772 | 5507 | 5257 | 5021 | 4797 | 4584 | 4380 |
| 54 | 7407 | 7026 | 6676 | 6351 | 6050 | 5768 | 5503 | 5253 | 5017 | 4793 | 4580 | 4377 |
| 55 | 7401 | 7020 | 6670 | 6346 | 6045 | 5763 | 5498 | 5249 | 5013 | 4789 | 4577 | 4374 |
| 56 | 7399 | 7014 | 6664 | 6341 | 6040 | 5758 | 5494 | 5245 | 5009 | 4786 | 4573 | 4370 |
| 57 | 7387 | 7008 | 6659 | 6336 | 6035 | 5754 | 5490 | 5241 | 5005 | 4782 | 4570 | 4367 |
| 58 | 7381 | 7002 | 6653 | 6331 | 6030 | 5749 | 5486 | 5237 | 5002 | 4778 | 4566 | 4364 |
| 59 | 7374 | 6996 | 6648 | 6325 | 6025 | 5745 | 5481 | 5233 | 4998 | 4775 | 4563 | 4361 |
| 60 | 7368 | 6990 | 6642 | 6320 | 6021 | 5740 | 5477 | 5229 | 4994 | 4771 | 4559 | 4357 |

The

# 16 The TABLE of Logistical Logarithms.

|    | 22   | 23   | 24   | 25   | 26   | 27   | 28   | 29   | 30   | 31   | 32   | 33   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|
|    | 1320 | 1380 | 1440 | 1500 | 1560 | 1620 | 1680 | 1740 | 1800 | 1860 | 1920 | 1980 |
| 0  | 4357 | 4164 | 3979 | 3802 | 3632 | 3468 | 3310 | 3158 | 3010 | 2868 | 2730 | 2596 |
| 1  | 4354 | 4161 | 3976 | 3799 | 3629 | 3465 | 3307 | 3155 | 3008 | 2866 | 2728 | 2594 |
| 2  | 4351 | 4158 | 3973 | 3796 | 3626 | 3463 | 3305 | 3153 | 3005 | 2863 | 2725 | 2592 |
| 3  | 4347 | 4155 | 3970 | 3793 | 3623 | 3460 | 3302 | 3150 | 3003 | 2861 | 2723 | 2590 |
| 4  | 4344 | 4152 | 3967 | 3791 | 3621 | 3457 | 3300 | 3148 | 3001 | 2859 | 2721 | 2588 |
| 5  | 4341 | 4149 | 3964 | 3788 | 3618 | 3454 | 3297 | 3145 | 2998 | 2856 | 2719 | 2585 |
| 6  | 4338 | 4145 | 3961 | 3785 | 3615 | 3452 | 3294 | 3143 | 2996 | 2854 | 2716 | 2583 |
| 7  | 4334 | 4142 | 3958 | 3782 | 3612 | 3449 | 3292 | 3140 | 2993 | 2852 | 2714 | 2581 |
| 8  | 4331 | 4139 | 3955 | 3779 | 3610 | 3446 | 3289 | 3138 | 2991 | 2849 | 2712 | 2579 |
| 9  | 4328 | 4136 | 3952 | 3776 | 3607 | 3444 | 3287 | 3135 | 2989 | 2847 | 2710 | 2577 |
| 10 | 4324 | 4133 | 3949 | 3773 | 3604 | 3441 | 3284 | 3133 | 2986 | 2845 | 2707 | 2574 |
| 11 | 4321 | 4130 | 3946 | 3770 | 3601 | 3438 | 3282 | 3130 | 2984 | 2842 | 2705 | 2572 |
| 12 | 4318 | 4127 | 3943 | 3768 | 3598 | 3436 | 3279 | 3128 | 2981 | 2840 | 2703 | 2570 |
| 13 | 4315 | 4124 | 3940 | 3765 | 3596 | 3433 | 3276 | 3125 | 2979 | 2838 | 2701 | 2568 |
| 14 | 4311 | 4120 | 3937 | 3762 | 3593 | 3431 | 3274 | 3123 | 2977 | 2835 | 2698 | 2566 |
| 15 | 4308 | 4117 | 3934 | 3759 | 3590 | 3428 | 3271 | 3120 | 2974 | 2833 | 2696 | 2564 |
| 16 | 4305 | 4114 | 3931 | 3756 | 3587 | 3425 | 3269 | 3118 | 2972 | 2831 | 2694 | 2561 |
| 17 | 4302 | 4111 | 3928 | 3753 | 3585 | 3423 | 3266 | 3115 | 2969 | 2828 | 2692 | 2559 |
| 18 | 4298 | 4108 | 3925 | 3750 | 3582 | 3420 | 3264 | 3113 | 2967 | 2826 | 2689 | 2557 |
| 19 | 4295 | 4105 | 3922 | 3747 | 3579 | 3417 | 3261 | 3110 | 2965 | 2824 | 2687 | 2555 |
| 20 | 4292 | 4102 | 3919 | 3745 | 3576 | 3415 | 3259 | 3108 | 2962 | 2821 | 2685 | 2553 |
| 21 | 4289 | 4099 | 3917 | 3742 | 3574 | 3412 | 3256 | 3105 | 2960 | 2819 | 2683 | 2551 |
| 22 | 4285 | 4096 | 3914 | 3739 | 3571 | 3409 | 3253 | 3103 | 2958 | 2817 | 2681 | 2548 |
| 23 | 4282 | 4092 | 3911 | 3736 | 3568 | 3407 | 3251 | 3101 | 2955 | 2815 | 2678 | 2546 |
| 24 | 4279 | 4089 | 3908 | 3733 | 3565 | 3404 | 3248 | 3098 | 2953 | 2812 | 2676 | 2544 |
| 25 | 4276 | 4086 | 3905 | 3730 | 3563 | 3401 | 3246 | 3096 | 2950 | 2810 | 2674 | 2542 |
| 26 | 4273 | 4083 | 3902 | 3727 | 3560 | 3399 | 3243 | 3093 | 2948 | 2808 | 2672 | 2540 |
| 27 | 4269 | 4080 | 3899 | 3725 | 3557 | 3396 | 3241 | 3091 | 2946 | 2805 | 2669 | 2538 |
| 28 | 4266 | 4077 | 3896 | 3722 | 3555 | 3393 | 3238 | 3088 | 2943 | 2803 | 2667 | 2535 |
| 29 | 4263 | 4074 | 3893 | 3719 | 3552 | 3391 | 3236 | 3086 | 2941 | 2801 | 2665 | 2533 |
| 30 | 4260 | 4071 | 3890 | 3716 | 3549 | 3388 | 3233 | 3083 | 2939 | 2798 | 2663 | 2531 |



# The TABLE of Logistical Logarithms.

17

22 23 24 25 26 27 28 29 30 31 32 33

1320 1380 1440 1500 1560 1620 1680 1740 1800 1860 1920 1980

|    |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|
| 30 | 4260 | 4071 | 3890 | 3716 | 3549 | 3388 | 3233 | 3083 | 2939 | 2798 | 2663 | 2531 |
| 31 | 4256 | 4068 | 3887 | 3713 | 3546 | 3386 | 3231 | 3081 | 2936 | 2796 | 2660 | 2529 |
| 32 | 4253 | 4065 | 3883 | 3710 | 3544 | 3383 | 3228 | 3078 | 2934 | 2794 | 2658 | 2527 |
| 33 | 4250 | 4062 | 3881 | 3708 | 3541 | 3380 | 3225 | 3076 | 2931 | 2792 | 2656 | 2525 |
| 34 | 4247 | 4059 | 3878 | 3705 | 3538 | 3378 | 3223 | 3073 | 2929 | 2789 | 2654 | 2522 |
| 35 | 4244 | 4055 | 3875 | 3702 | 3535 | 3375 | 3220 | 3071 | 2927 | 2787 | 2652 | 2520 |
| 36 | 4240 | 4052 | 3872 | 3699 | 3533 | 3372 | 3218 | 3069 | 2924 | 2785 | 2649 | 2518 |
| 37 | 4237 | 4049 | 3869 | 3696 | 3530 | 3370 | 3215 | 3066 | 2922 | 2782 | 2647 | 2516 |
| 38 | 4234 | 4046 | 3866 | 3693 | 3527 | 3367 | 3213 | 3064 | 2920 | 2780 | 2645 | 2514 |
| 39 | 4231 | 4043 | 3863 | 3691 | 3525 | 3365 | 3210 | 3061 | 2917 | 2778 | 2643 | 2512 |
| 40 | 4228 | 4040 | 3860 | 3688 | 3522 | 3362 | 3208 | 3059 | 2915 | 2775 | 2640 | 2510 |
| 41 | 4224 | 4037 | 3857 | 3685 | 3519 | 3359 | 3205 | 3056 | 2912 | 2773 | 2638 | 2507 |
| 42 | 4221 | 4034 | 3855 | 3682 | 3516 | 3357 | 3203 | 3054 | 2910 | 2771 | 2636 | 2505 |
| 43 | 4218 | 4031 | 3852 | 3679 | 3514 | 3354 | 3200 | 3052 | 2908 | 2769 | 2634 | 2503 |
| 44 | 4215 | 4028 | 3849 | 3677 | 3511 | 3351 | 3198 | 3049 | 2905 | 2766 | 2632 | 2501 |
| 45 | 4212 | 4025 | 3846 | 3674 | 3508 | 3349 | 3195 | 3047 | 2903 | 2764 | 2629 | 2499 |
| 46 | 4209 | 4022 | 3843 | 3671 | 3506 | 3346 | 3193 | 3044 | 2901 | 2762 | 2627 | 2497 |
| 47 | 4205 | 4019 | 3840 | 3668 | 3502 | 3344 | 3190 | 3042 | 2898 | 2760 | 2625 | 2494 |
| 48 | 4202 | 4016 | 3837 | 3665 | 3500 | 3341 | 3188 | 3039 | 2896 | 2757 | 2623 | 2492 |
| 49 | 4199 | 4013 | 3834 | 3663 | 3497 | 3338 | 3185 | 3037 | 2894 | 2755 | 2621 | 2490 |
| 50 | 4196 | 4010 | 3831 | 3660 | 3495 | 3336 | 3183 | 3034 | 2891 | 2753 | 2618 | 2488 |
| 51 | 4193 | 4007 | 3828 | 3657 | 3492 | 3333 | 3180 | 3032 | 2889 | 2750 | 2616 | 2486 |
| 52 | 4189 | 4004 | 3825 | 3654 | 3489 | 3331 | 3178 | 3030 | 2887 | 2748 | 2614 | 2484 |
| 53 | 4186 | 4001 | 3822 | 3651 | 3487 | 3328 | 3175 | 3027 | 2884 | 2746 | 2612 | 2482 |
| 54 | 4183 | 3998 | 3820 | 3649 | 3484 | 3325 | 3173 | 3025 | 2882 | 2744 | 2610 | 2480 |
| 55 | 4180 | 3995 | 3817 | 3646 | 3481 | 3323 | 3170 | 3022 | 2880 | 2741 | 2607 | 2477 |
| 56 | 4177 | 3991 | 3814 | 3643 | 3479 | 3320 | 3168 | 3020 | 2877 | 2739 | 2605 | 2475 |
| 57 | 4174 | 3988 | 3811 | 3640 | 3476 | 3318 | 3165 | 3018 | 2875 | 2737 | 2603 | 2473 |
| 58 | 4171 | 3985 | 3808 | 3637 | 3473 | 3315 | 3163 | 3015 | 2873 | 2735 | 2601 | 2471 |
| 59 | 4167 | 3982 | 3805 | 3635 | 3471 | 3313 | 3160 | 3013 | 2870 | 2732 | 2599 | 2469 |
| 60 | 4164 | 3979 | 3802 | 3632 | 3468 | 3310 | 3158 | 3010 | 2868 | 2730 | 2596 | 2467 |

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# 18 The TABLE of Logistical Logarithms.

| 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45

| 2040 | 2100 | 2160 | 2220 | 2280 | 2340 | 2400 | 2460 | 2520 | 2580 | 2640 | 2700

|    |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|
| 0  | 2467 | 2341 | 2218 | 2099 | 1984 | 1871 | 1761 | 1654 | 1549 | 1447 | 1347 | 1249 |
| 1  | 2465 | 2339 | 2216 | 2098 | 1982 | 1869 | 1759 | 1652 | 1547 | 1445 | 1345 | 1248 |
| 2  | 2462 | 2337 | 2214 | 2096 | 1980 | 1867 | 1757 | 1650 | 1546 | 1443 | 1344 | 1246 |
| 3  | 2460 | 2335 | 2212 | 2094 | 1978 | 1865 | 1755 | 1648 | 1544 | 1442 | 1342 | 1245 |
| 4  | 2458 | 2333 | 2210 | 2092 | 1976 | 1863 | 1754 | 1647 | 1542 | 1440 | 1340 | 1243 |
| 5  | 2456 | 2331 | 2208 | 2090 | 1974 | 1862 | 1752 | 1645 | 1540 | 1438 | 1339 | 1241 |
| 6  | 2454 | 2328 | 2206 | 2088 | 1972 | 1860 | 1750 | 1643 | 1539 | 1437 | 1337 | 1240 |
| 7  | 2452 | 2326 | 2204 | 2086 | 1970 | 1858 | 1748 | 1641 | 1537 | 1535 | 1335 | 1238 |
| 8  | 2450 | 2324 | 2202 | 2084 | 1968 | 1856 | 1746 | 1640 | 1535 | 1433 | 1334 | 1237 |
| 9  | 2448 | 2322 | 2200 | 2082 | 1967 | 1854 | 1745 | 1638 | 1534 | 1432 | 1332 | 1235 |
| 10 | 2445 | 2320 | 2198 | 2080 | 1965 | 1852 | 1743 | 1636 | 1532 | 1430 | 1331 | 1233 |
| 11 | 2443 | 2318 | 2196 | 2078 | 1963 | 1850 | 1741 | 1634 | 1530 | 1428 | 1329 | 1232 |
| 12 | 2441 | 2316 | 2194 | 2076 | 1961 | 1849 | 1739 | 1633 | 1528 | 1427 | 1327 | 1230 |
| 13 | 2439 | 2314 | 2192 | 2074 | 1959 | 1847 | 1737 | 1631 | 1527 | 1425 | 1326 | 1229 |
| 14 | 2437 | 2312 | 2190 | 2072 | 1957 | 1845 | 1736 | 1629 | 1525 | 1423 | 1324 | 1227 |
| 15 | 2435 | 2310 | 2188 | 2070 | 1955 | 1843 | 1734 | 1627 | 1523 | 1422 | 1322 | 1225 |
| 16 | 2433 | 2308 | 2186 | 2068 | 1953 | 1841 | 1733 | 1626 | 1522 | 1420 | 1321 | 1224 |
| 17 | 2431 | 2306 | 2184 | 2066 | 1951 | 1839 | 1730 | 1624 | 1520 | 1418 | 1319 | 1222 |
| 18 | 2429 | 2304 | 2182 | 2064 | 1950 | 1838 | 1728 | 1622 | 1518 | 1417 | 1317 | 1221 |
| 19 | 2426 | 2302 | 2180 | 2062 | 1948 | 1836 | 1727 | 1620 | 1516 | 1415 | 1316 | 1219 |
| 20 | 2424 | 2300 | 2178 | 2061 | 1946 | 1834 | 1725 | 1619 | 1515 | 1413 | 1314 | 1217 |
| 21 | 2422 | 2298 | 2176 | 2059 | 1944 | 1832 | 1723 | 1617 | 1513 | 1412 | 1313 | 1216 |
| 22 | 2420 | 2296 | 2174 | 2057 | 1942 | 1830 | 1721 | 1615 | 1511 | 1410 | 1311 | 1214 |
| 23 | 2418 | 2294 | 2172 | 2055 | 1940 | 1828 | 1719 | 1613 | 1510 | 1408 | 1309 | 1213 |
| 24 | 2416 | 2291 | 2170 | 2053 | 1938 | 1827 | 1718 | 1612 | 1508 | 1407 | 1308 | 1211 |
| 25 | 2414 | 2289 | 2169 | 2051 | 1936 | 1825 | 1716 | 1610 | 1506 | 1405 | 1306 | 1209 |
| 26 | 2412 | 2287 | 2167 | 2049 | 1934 | 1823 | 1714 | 1608 | 1504 | 1403 | 1304 | 1208 |
| 27 | 2410 | 2285 | 2165 | 2047 | 1933 | 1821 | 1712 | 1606 | 1503 | 1402 | 1302 | 1206 |
| 28 | 2408 | 2283 | 2163 | 2045 | 1931 | 1819 | 1711 | 1605 | 1501 | 1400 | 1301 | 1205 |
| 29 | 2405 | 2281 | 2161 | 2043 | 1929 | 1817 | 1709 | 1603 | 1499 | 1398 | 1300 | 1203 |
| 30 | 2403 | 2279 | 2159 | 2041 | 1927 | 1816 | 1707 | 1601 | 1498 | 1297 | 1298 | 1201 |



# The TABLE of *Logistical Logarithms.* 19

|                                                                                     | 34   | 35   | 36   | 37   | 38   | 39   | 40   | 41   | 42   | 43   | 44   | 45   |
|-------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| " 2040   2100   2160   2220   2280   2340   2400   2460   2520   2580   2640   2700 |      |      |      |      |      |      |      |      |      |      |      |      |
| 30                                                                                  | 2403 | 2279 | 2159 | 2041 | 1927 | 1816 | 1707 | 1601 | 1498 | 1397 | 1298 | 1201 |
| 31                                                                                  | 2401 | 2277 | 2157 | 2039 | 1925 | 1814 | 1705 | 1599 | 1496 | 1395 | 1296 | 1200 |
| 32                                                                                  | 2399 | 2275 | 2155 | 2037 | 1923 | 1812 | 1703 | 1598 | 1494 | 1393 | 1295 | 1198 |
| 33                                                                                  | 2397 | 2273 | 2153 | 2035 | 1921 | 1810 | 1702 | 1596 | 1493 | 1392 | 1293 | 1197 |
| 34                                                                                  | 2395 | 2272 | 2151 | 2033 | 1919 | 1808 | 1700 | 1594 | 1491 | 1390 | 1291 | 1195 |
| 35                                                                                  | 2393 | 2269 | 2149 | 2032 | 1918 | 1806 | 1698 | 1592 | 1489 | 1388 | 1290 | 1193 |
| 36                                                                                  | 2391 | 2267 | 2147 | 2030 | 1916 | 1805 | 1696 | 1591 | 1487 | 1387 | 1288 | 1192 |
| 37                                                                                  | 2389 | 2265 | 2145 | 2028 | 1914 | 1803 | 1694 | 1589 | 1486 | 1385 | 1287 | 1190 |
| 38                                                                                  | 2387 | 2263 | 2143 | 2026 | 1912 | 1801 | 1693 | 1587 | 1484 | 1383 | 1285 | 1189 |
| 39                                                                                  | 2384 | 2261 | 2141 | 2024 | 1910 | 1799 | 1691 | 1585 | 1482 | 1382 | 1283 | 1187 |
| 40                                                                                  | 2382 | 2259 | 2139 | 2022 | 1908 | 1797 | 1689 | 1584 | 1481 | 1380 | 1282 | 1186 |
| 41                                                                                  | 2380 | 2257 | 2137 | 2020 | 1906 | 1795 | 1687 | 1582 | 1479 | 1378 | 1280 | 1184 |
| 42                                                                                  | 2378 | 2255 | 2135 | 2018 | 1904 | 1794 | 1686 | 1580 | 1477 | 1377 | 1278 | 1182 |
| 43                                                                                  | 2376 | 2253 | 2133 | 2016 | 1903 | 1792 | 1684 | 1578 | 1476 | 1375 | 1277 | 1181 |
| 44                                                                                  | 2374 | 2251 | 2131 | 2014 | 1901 | 1790 | 1682 | 1577 | 1475 | 1373 | 1275 | 1179 |
| 45                                                                                  | 2372 | 2249 | 2129 | 2012 | 1899 | 1788 | 1680 | 1575 | 1472 | 1372 | 1274 | 1178 |
| 46                                                                                  | 2370 | 2247 | 2127 | 2010 | 1897 | 1786 | 1678 | 1573 | 1470 | 1370 | 1272 | 1176 |
| 47                                                                                  | 2368 | 2245 | 2125 | 2009 | 1895 | 1785 | 1677 | 1571 | 1469 | 1368 | 1270 | 1174 |
| 48                                                                                  | 2366 | 2243 | 2123 | 2007 | 1893 | 1783 | 1675 | 1570 | 1467 | 1367 | 1269 | 1173 |
| 49                                                                                  | 2364 | 2241 | 2121 | 2005 | 1891 | 1781 | 1673 | 1568 | 1465 | 1365 | 1267 | 1171 |
| 50                                                                                  | 2362 | 2239 | 2119 | 2003 | 1889 | 1779 | 1671 | 1566 | 1464 | 1363 | 1266 | 1170 |
| 51                                                                                  | 2359 | 2237 | 2117 | 2001 | 1888 | 1777 | 1670 | 1565 | 1462 | 1362 | 1264 | 1168 |
| 52                                                                                  | 2357 | 2235 | 2115 | 1999 | 1886 | 1775 | 1668 | 1563 | 1460 | 1360 | 1262 | 1167 |
| 53                                                                                  | 2355 | 2233 | 2113 | 1997 | 1884 | 1774 | 1666 | 1561 | 1459 | 1359 | 1261 | 1165 |
| 54                                                                                  | 2353 | 2231 | 2111 | 1995 | 1882 | 1772 | 1664 | 1559 | 1457 | 1357 | 1259 | 1163 |
| 55                                                                                  | 2351 | 2229 | 2109 | 1993 | 1880 | 1770 | 1663 | 1558 | 1455 | 1355 | 1257 | 1162 |
| 56                                                                                  | 2349 | 2227 | 2107 | 1991 | 1878 | 1768 | 1661 | 1556 | 1454 | 1354 | 1256 | 1160 |
| 57                                                                                  | 2347 | 2225 | 2105 | 1989 | 1876 | 1766 | 1659 | 1554 | 1452 | 1352 | 1254 | 1159 |
| 58                                                                                  | 2345 | 2223 | 2103 | 1987 | 1875 | 1765 | 1657 | 1552 | 1450 | 1350 | 1253 | 1157 |
| 59                                                                                  | 2343 | 2220 | 2101 | 1986 | 1873 | 1763 | 1655 | 1551 | 1449 | 1349 | 1251 | 1156 |
| 60                                                                                  | 2341 | 2218 | 2099 | 1984 | 1871 | 1761 | 1654 | 1549 | 1447 | 1347 | 1249 | 1154 |

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# 20 The TABLE of Logistical Logarithms.

|    | 146  | 147  | 148  | 149  | 150  | 151  | 152  | 153  | 154  | 155  | 156  | 157  | 158  | 159  |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| "  | 2760 | 2820 | 2880 | 2940 | 3000 | 3060 | 3120 | 3180 | 3240 | 3300 | 3360 | 3420 | 3480 | 3540 |
| 0  | 1154 | 1061 | 969  | 880  | 792  | 706  | 621  | 539  | 458  | 378  | 300  | 223  | 147  | 73   |
| 1  | 1152 | 1059 | 968  | 878  | 790  | 704  | 620  | 537  | 456  | 377  | 298  | 221  | 146  | 72   |
| 2  | 1151 | 1057 | 966  | 877  | 789  | 703  | 619  | 536  | 455  | 375  | 297  | 220  | 145  | 71   |
| 3  | 1149 | 1056 | 965  | 875  | 787  | 702  | 617  | 535  | 454  | 374  | 296  | 219  | 143  | 69   |
| 4  | 1148 | 1054 | 963  | 874  | 786  | 700  | 616  | 533  | 452  | 373  | 294  | 218  | 142  | 68   |
| 5  | 1146 | 1053 | 962  | 872  | 485  | 699  | 615  | 532  | 451  | 371  | 293  | 216  | 141  | 67   |
| 6  | 1145 | 1051 | 960  | 871  | 783  | 697  | 613  | 531  | 450  | 370  | 292  | 215  | 140  | 66   |
| 7  | 1143 | 1050 | 959  | 869  | 782  | 696  | 612  | 529  | 448  | 369  | 291  | 214  | 139  | 64   |
| 8  | 1141 | 1048 | 957  | 868  | 780  | 694  | 610  | 528  | 447  | 367  | 289  | 213  | 137  | 63   |
| 9  | 1140 | 1047 | 956  | 866  | 779  | 693  | 609  | 526  | 446  | 366  | 288  | 211  | 136  | 62   |
| 10 | 1138 | 1045 | 954  | 865  | 777  | 692  | 608  | 525  | 444  | 365  | 287  | 210  | 135  | 61   |
| 11 | 1137 | 1044 | 953  | 863  | 776  | 690  | 606  | 524  | 443  | 363  | 285  | 209  | 134  | 60   |
| 12 | 1135 | 1042 | 951  | 862  | 774  | 689  | 605  | 522  | 442  | 362  | 284  | 208  | 132  | 58   |
| 13 | 1134 | 1041 | 950  | 860  | 773  | 687  | 603  | 521  | 440  | 361  | 283  | 206  | 131  | 57   |
| 14 | 1132 | 1039 | 948  | 859  | 772  | 686  | 602  | 520  | 439  | 359  | 282  | 205  | 130  | 56   |
| 15 | 1130 | 1037 | 947  | 857  | 770  | 685  | 601  | 518  | 438  | 358  | 280  | 204  | 129  | 55   |
| 16 | 1129 | 1036 | 945  | 856  | 769  | 683  | 599  | 517  | 436  | 357  | 279  | 202  | 127  | 53   |
| 17 | 1127 | 1034 | 944  | 855  | 767  | 682  | 598  | 516  | 435  | 356  | 278  | 201  | 126  | 52   |
| 18 | 1126 | 1033 | 942  | 853  | 766  | 680  | 596  | 514  | 434  | 354  | 276  | 200  | 125  | 51   |
| 19 | 1124 | 1031 | 941  | 852  | 764  | 679  | 595  | 513  | 432  | 353  | 275  | 199  | 124  | 50   |
| 20 | 1123 | 1030 | 939  | 850  | 763  | 678  | 594  | 512  | 431  | 352  | 274  | 197  | 122  | 49   |
| 21 | 1121 | 1028 | 938  | 849  | 762  | 676  | 592  | 510  | 430  | 350  | 273  | 196  | 121  | 47   |
| 22 | 1119 | 1027 | 936  | 847  | 760  | 675  | 591  | 509  | 428  | 349  | 271  | 195  | 120  | 46   |
| 23 | 1118 | 1025 | 935  | 846  | 759  | 673  | 590  | 507  | 427  | 348  | 270  | 194  | 119  | 45   |
| 24 | 1116 | 1024 | 933  | 844  | 757  | 672  | 588  | 506  | 426  | 346  | 269  | 192  | 117  | 44   |
| 25 | 1115 | 1022 | 932  | 843  | 756  | 670  | 587  | 505  | 424  | 345  | 267  | 191  | 116  | 42   |
| 26 | 1113 | 1021 | 930  | 841  | 754  | 669  | 585  | 503  | 423  | 344  | 266  | 190  | 115  | 41   |
| 27 | 1112 | 1019 | 929  | 840  | 753  | 668  | 584  | 502  | 422  | 342  | 265  | 189  | 114  | 40   |
| 28 | 1110 | 1018 | 927  | 838  | 751  | 666  | 583  | 501  | 420  | 341  | 264  | 187  | 113  | 39   |
| 29 | 1109 | 1016 | 926  | 837  | 750  | 665  | 581  | 499  | 419  | 340  | 262  | 186  | 111  | 38   |
| 30 | 1107 | 1015 | 924  | 835  | 749  | 663  | 580  | 498  | 418  | 339  | 261  | 185  | 110  | 36   |



# The TABLE of Logistical Logarithms.

21

46 47 48 49 50 51 52 53 54 55 56 57 58 59

2760 2820 2880 2940 3000 3060 3120 3180 3240 3300 3360 3420 3480 3540

|    |      |      |     |     |     |     |     |     |     |     |     |     |     |    |
|----|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 30 | 1107 | 1015 | 924 | 835 | 749 | 663 | 580 | 498 | 418 | 339 | 261 | 185 | 110 | 36 |
| 31 | 1105 | 1013 | 923 | 834 | 747 | 662 | 579 | 497 | 416 | 337 | 260 | 184 | 109 | 35 |
| 32 | 1104 | 1012 | 921 | 833 | 746 | 661 | 577 | 495 | 415 | 336 | 258 | 182 | 107 | 34 |
| 33 | 1102 | 1010 | 920 | 831 | 744 | 659 | 576 | 494 | 414 | 335 | 257 | 181 | 106 | 33 |
| 34 | 1101 | 1008 | 918 | 830 | 743 | 658 | 574 | 493 | 412 | 333 | 256 | 180 | 105 | 31 |
| 35 | 1099 | 1007 | 917 | 828 | 741 | 656 | 573 | 491 | 411 | 332 | 255 | 179 | 104 | 30 |
| 36 | 1098 | 1005 | 915 | 827 | 740 | 655 | 572 | 490 | 410 | 331 | 253 | 177 | 103 | 29 |
| 37 | 1096 | 1004 | 914 | 825 | 739 | 654 | 570 | 489 | 408 | 329 | 252 | 176 | 101 | 28 |
| 38 | 1095 | 1002 | 912 | 824 | 737 | 652 | 569 | 487 | 407 | 328 | 251 | 175 | 100 | 27 |
| 39 | 1093 | 1001 | 911 | 822 | 736 | 651 | 568 | 486 | 406 | 327 | 250 | 174 | 99  | 25 |
| 40 | 1091 | 999  | 909 | 821 | 734 | 649 | 566 | 484 | 404 | 326 | 248 | 172 | 98  | 24 |
| 41 | 1090 | 998  | 908 | 819 | 733 | 648 | 565 | 483 | 403 | 324 | 247 | 171 | 96  | 23 |
| 42 | 1088 | 996  | 906 | 818 | 731 | 647 | 563 | 482 | 402 | 323 | 246 | 170 | 95  | 2  |
| 43 | 1087 | 995  | 905 | 816 | 730 | 645 | 562 | 480 | 400 | 321 | 244 | 169 | 94  | 21 |
| 44 | 1085 | 993  | 903 | 815 | 729 | 644 | 561 | 479 | 399 | 320 | 243 | 167 | 93  | 19 |
| 45 | 1084 | 992  | 902 | 814 | 727 | 642 | 559 | 478 | 398 | 319 | 242 | 166 | 91  | 18 |
| 46 | 1082 | 990  | 900 | 812 | 726 | 641 | 558 | 476 | 396 | 318 | 241 | 165 | 90  | 17 |
| 47 | 1081 | 989  | 899 | 811 | 724 | 640 | 557 | 475 | 395 | 316 | 239 | 163 | 89  | 16 |
| 48 | 1079 | 987  | 897 | 809 | 723 | 638 | 555 | 474 | 394 | 315 | 238 | 162 | 88  | 15 |
| 49 | 1078 | 986  | 896 | 808 | 721 | 637 | 554 | 472 | 392 | 314 | 237 | 161 | 87  | 13 |
| 50 | 1076 | 984  | 894 | 806 | 720 | 635 | 552 | 471 | 391 | 313 | 235 | 160 | 85  | 12 |
| 51 | 1074 | 983  | 893 | 805 | 719 | 634 | 551 | 470 | 390 | 311 | 234 | 158 | 84  | 11 |
| 52 | 1073 | 981  | 891 | 803 | 717 | 633 | 550 | 468 | 388 | 310 | 233 | 157 | 83  | 10 |
| 53 | 1071 | 980  | 890 | 802 | 716 | 631 | 548 | 467 | 387 | 309 | 232 | 156 | 82  | 8  |
| 54 | 1070 | 978  | 888 | 801 | 714 | 630 | 547 | 466 | 386 | 307 | 230 | 155 | 80  | 7  |
| 55 | 1068 | 977  | 887 | 799 | 713 | 628 | 546 | 464 | 384 | 306 | 229 | 153 | 79  | 6  |
| 56 | 1067 | 975  | 885 | 798 | 711 | 627 | 544 | 463 | 383 | 305 | 228 | 152 | 78  | 5  |
| 57 | 1065 | 974  | 884 | 796 | 710 | 626 | 543 | 462 | 382 | 304 | 227 | 151 | 77  | 4  |
| 58 | 1064 | 972  | 883 | 795 | 709 | 624 | 541 | 460 | 381 | 302 | 225 | 150 | 75  | 3  |
| 59 | 1062 | 971  | 881 | 793 | 707 | 623 | 540 | 459 | 379 | 301 | 224 | 148 | 74  | 1  |
| 60 | 1061 | 969  | 880 | 792 | 706 | 621 | 539 | 458 | 378 | 300 | 223 | 147 | 73  | 0  |

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The

# 20 The TABLE of Logistical Logarithms.

|    | 146  | 147  | 148  | 149  | 150  | 151  | 152  | 153  | 154  | 155  | 156  | 157  | 158  | 159  |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 11 | 2760 | 2820 | 2880 | 2940 | 3000 | 3060 | 3120 | 3180 | 3240 | 3300 | 3360 | 3420 | 3480 | 3540 |
| 0  | 1154 | 1061 | 969  | 880  | 792  | 706  | 621  | 539  | 458  | 378  | 300  | 223  | 147  | 73   |
| 1  | 1152 | 1059 | 968  | 878  | 790  | 704  | 620  | 537  | 456  | 377  | 298  | 221  | 146  | 72   |
| 2  | 1151 | 1057 | 966  | 877  | 789  | 703  | 619  | 536  | 455  | 375  | 297  | 220  | 145  | 71   |
| 3  | 1149 | 1056 | 965  | 875  | 787  | 702  | 617  | 535  | 454  | 374  | 296  | 219  | 143  | 69   |
| 4  | 1148 | 1054 | 963  | 874  | 786  | 700  | 616  | 533  | 452  | 373  | 294  | 218  | 142  | 68   |
| 5  | 1146 | 1053 | 962  | 872  | 785  | 699  | 615  | 532  | 451  | 371  | 293  | 216  | 141  | 67   |
| 6  | 1145 | 1051 | 960  | 871  | 783  | 697  | 613  | 531  | 450  | 370  | 292  | 215  | 140  | 66   |
| 7  | 1143 | 1050 | 959  | 869  | 782  | 696  | 612  | 529  | 448  | 369  | 291  | 214  | 139  | 64   |
| 8  | 1141 | 1048 | 957  | 868  | 780  | 694  | 610  | 528  | 447  | 367  | 289  | 213  | 137  | 63   |
| 9  | 1140 | 1047 | 956  | 866  | 779  | 693  | 609  | 526  | 446  | 366  | 288  | 211  | 136  | 62   |
| 10 | 1138 | 1045 | 954  | 865  | 777  | 692  | 608  | 525  | 444  | 365  | 287  | 210  | 135  | 61   |
| 11 | 1137 | 1044 | 953  | 863  | 776  | 690  | 606  | 524  | 443  | 363  | 285  | 209  | 134  | 60   |
| 12 | 1135 | 1042 | 951  | 862  | 774  | 689  | 605  | 522  | 442  | 362  | 284  | 208  | 132  | 58   |
| 13 | 1134 | 1041 | 950  | 860  | 773  | 687  | 603  | 521  | 440  | 361  | 283  | 206  | 131  | 57   |
| 14 | 1132 | 1039 | 948  | 859  | 772  | 686  | 602  | 520  | 439  | 359  | 282  | 205  | 130  | 56   |
| 15 | 1130 | 1037 | 947  | 857  | 770  | 685  | 601  | 518  | 438  | 358  | 280  | 204  | 129  | 55   |
| 16 | 1129 | 1036 | 945  | 856  | 769  | 683  | 599  | 517  | 436  | 357  | 279  | 202  | 127  | 53   |
| 17 | 1127 | 1034 | 944  | 855  | 767  | 682  | 598  | 516  | 435  | 356  | 278  | 201  | 126  | 52   |
| 18 | 1126 | 1033 | 942  | 853  | 766  | 680  | 596  | 514  | 434  | 354  | 276  | 200  | 125  | 51   |
| 19 | 1124 | 1031 | 941  | 852  | 764  | 679  | 595  | 513  | 432  | 353  | 275  | 199  | 124  | 50   |
| 20 | 1123 | 1030 | 939  | 850  | 763  | 678  | 594  | 512  | 431  | 352  | 274  | 197  | 122  | 49   |
| 21 | 1121 | 1028 | 938  | 849  | 762  | 676  | 592  | 510  | 430  | 350  | 273  | 196  | 121  | 47   |
| 22 | 1119 | 1027 | 936  | 847  | 760  | 675  | 591  | 509  | 428  | 349  | 271  | 195  | 120  | 46   |
| 23 | 1118 | 1025 | 935  | 846  | 759  | 673  | 590  | 507  | 427  | 348  | 270  | 194  | 119  | 45   |
| 24 | 1116 | 1024 | 933  | 844  | 757  | 672  | 588  | 506  | 426  | 346  | 269  | 192  | 117  | 44   |
| 25 | 1115 | 1022 | 932  | 843  | 756  | 670  | 587  | 505  | 424  | 345  | 267  | 191  | 116  | 42   |
| 26 | 1113 | 1021 | 930  | 841  | 754  | 669  | 585  | 503  | 423  | 344  | 266  | 190  | 115  | 41   |
| 27 | 1112 | 1019 | 929  | 840  | 753  | 668  | 584  | 502  | 422  | 342  | 265  | 189  | 114  | 40   |
| 28 | 1110 | 1018 | 927  | 838  | 751  | 666  | 583  | 501  | 420  | 341  | 264  | 187  | 113  | 39   |
| 29 | 1109 | 1016 | 926  | 837  | 750  | 665  | 581  | 499  | 419  | 340  | 262  | 186  | 111  | 38   |
| 30 | 1107 | 1015 | 924  | 835  | 749  | 663  | 580  | 498  | 418  | 339  | 261  | 185  | 110  | 36   |



# The TABLE of Logistical Logarithms. 21

' 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59

" | 2760 | 2820 | 2880 | 2940 | 3000 | 3060 | 3120 | 3180 | 3240 | 3300 | 3360 | 3420 | 3480 | 3540

|    |      |      |     |     |     |     |     |     |     |     |     |     |     |    |
|----|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 30 | 1107 | 1015 | 924 | 835 | 749 | 663 | 500 | 498 | 418 | 339 | 261 | 185 | 110 | 36 |
| 31 | 1105 | 1013 | 923 | 834 | 747 | 662 | 579 | 497 | 416 | 337 | 260 | 184 | 109 | 35 |
| 32 | 1104 | 1012 | 921 | 833 | 746 | 661 | 577 | 495 | 415 | 336 | 258 | 182 | 107 | 34 |
| 33 | 1102 | 1010 | 920 | 831 | 744 | 659 | 576 | 494 | 414 | 335 | 257 | 181 | 106 | 33 |
| 34 | 1101 | 1008 | 918 | 830 | 743 | 658 | 574 | 493 | 412 | 333 | 256 | 180 | 105 | 31 |
| 35 | 1099 | 1007 | 917 | 828 | 741 | 656 | 573 | 491 | 411 | 332 | 255 | 179 | 104 | 30 |
| 36 | 1098 | 1005 | 915 | 827 | 740 | 655 | 572 | 490 | 410 | 331 | 253 | 177 | 103 | 29 |
| 37 | 1096 | 1004 | 914 | 825 | 739 | 654 | 570 | 489 | 408 | 329 | 252 | 176 | 101 | 28 |
| 38 | 1095 | 1002 | 912 | 824 | 737 | 652 | 569 | 487 | 407 | 328 | 251 | 175 | 100 | 27 |
| 39 | 1093 | 1001 | 911 | 822 | 736 | 651 | 568 | 486 | 406 | 327 | 250 | 174 | 99  | 25 |
| 40 | 1091 | 999  | 909 | 821 | 734 | 649 | 566 | 484 | 404 | 326 | 248 | 172 | 98  | 24 |
| 41 | 1090 | 998  | 908 | 819 | 733 | 648 | 565 | 483 | 403 | 324 | 247 | 171 | 96  | 23 |
| 42 | 1088 | 996  | 906 | 818 | 731 | 647 | 563 | 482 | 402 | 323 | 246 | 170 | 95  | 2  |
| 43 | 1087 | 995  | 905 | 816 | 730 | 645 | 562 | 480 | 400 | 322 | 244 | 169 | 94  | 21 |
| 44 | 1085 | 993  | 903 | 815 | 729 | 644 | 561 | 479 | 399 | 320 | 243 | 167 | 93  | 19 |
| 45 | 1084 | 992  | 902 | 814 | 727 | 642 | 559 | 478 | 398 | 319 | 242 | 166 | 91  | 18 |
| 46 | 1082 | 990  | 900 | 812 | 726 | 641 | 558 | 476 | 396 | 318 | 241 | 165 | 90  | 17 |
| 47 | 1081 | 989  | 899 | 811 | 724 | 640 | 557 | 475 | 395 | 316 | 239 | 163 | 89  | 16 |
| 48 | 1079 | 987  | 897 | 809 | 723 | 638 | 555 | 474 | 394 | 315 | 238 | 162 | 88  | 15 |
| 49 | 1078 | 986  | 896 | 808 | 721 | 637 | 554 | 472 | 392 | 314 | 237 | 161 | 87  | 13 |
| 50 | 1076 | 984  | 894 | 806 | 720 | 635 | 552 | 471 | 391 | 313 | 235 | 160 | 85  | 12 |
| 51 | 1074 | 983  | 893 | 805 | 719 | 634 | 551 | 470 | 390 | 311 | 234 | 158 | 84  | 11 |
| 52 | 1073 | 981  | 891 | 803 | 717 | 633 | 550 | 468 | 388 | 310 | 233 | 157 | 83  | 10 |
| 53 | 1071 | 980  | 890 | 802 | 716 | 631 | 548 | 467 | 387 | 309 | 232 | 156 | 82  | 8  |
| 54 | 1070 | 978  | 888 | 801 | 714 | 630 | 547 | 466 | 386 | 307 | 230 | 155 | 80  | 7  |
| 55 | 1068 | 977  | 887 | 799 | 713 | 628 | 546 | 464 | 384 | 306 | 229 | 153 | 79  | 6  |
| 56 | 1067 | 975  | 885 | 798 | 711 | 627 | 544 | 463 | 383 | 305 | 228 | 152 | 78  | 5  |
| 57 | 1065 | 974  | 884 | 796 | 710 | 626 | 543 | 462 | 382 | 304 | 227 | 151 | 77  | 4  |
| 58 | 1064 | 972  | 883 | 795 | 709 | 624 | 541 | 460 | 381 | 302 | 225 | 150 | 75  | 3  |
| 59 | 1062 | 971  | 881 | 793 | 707 | 623 | 540 | 459 | 379 | 301 | 224 | 148 | 74  | 1  |
| 60 | 1061 | 969  | 880 | 792 | 706 | 621 | 539 | 458 | 378 | 300 | 223 | 147 | 73  | 0  |

The First Equation of Apparent Time. Subtract from the Apparent Time  
if the Sun's mean Anomaly be

| Sign. | 1  | 2  | 3  | 4  | 5  |    |    |    |    |    |    |    |    |    |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0     | 1  | 2  | 3  | 4  | 5  |    |    |    |    |    |    |    |    |    |
| 0     | 0. | 0  | 0  | 3. | 46 | 6. | 34 | 7. | 40 | 6. | 42 | 3. | 54 | 30 |
| 1     | 0. | 08 | 3. | 53 | 6. | 38 | 7. | 40 | 6. | 38 | 3. | 47 | 29 |    |
| 2     | 0. | 16 | 3. | 59 | 6. | 42 | 7. | 40 | 6. | 34 | 3. | 40 | 28 |    |
| 3     | 0. | 23 | 4. | 06 | 6. | 46 | 7. | 40 | 6. | 30 | 3. | 33 | 27 |    |
| 4     | 0. | 31 | 4. | 13 | 6. | 49 | 7. | 39 | 6. | 26 | 3. | 25 | 26 |    |
| 5     | 0. | 39 | 4. | 19 | 6. | 53 | 7. | 39 | 6. | 21 | 3. | 18 | 25 |    |
| 6     | 0. | 47 | 4. | 26 | 6. | 57 | 7. | 38 | 6. | 17 | 3. | 11 | 24 |    |
| 7     | 0. | 55 | 4. | 32 | 7. | 00 | 7. | 38 | 6. | 12 | 3. | 03 | 23 |    |
| 8     | 1. | 03 | 4. | 38 | 7. | 03 | 7. | 37 | 6. | 07 | 2. | 56 | 22 |    |
| 9     | 1. | 10 | 4. | 45 | 7. | 06 | 7. | 36 | 6. | 02 | 2. | 48 | 21 |    |
| 10    | 1. | 18 | 4. | 51 | 7. | 09 | 7. | 34 | 5. | 57 | 2. | 40 | 20 |    |
| 11    | 1. | 26 | 4. | 57 | 7. | 12 | 7. | 33 | 5. | 52 | 2. | 33 | 19 |    |
| 12    | 1. | 34 | 5. | 03 | 7. | 14 | 7. | 32 | 5. | 43 | 2. | 25 | 18 |    |
| 13    | 1. | 41 | 5. | 09 | 7. | 17 | 7. | 30 | 5. | 41 | 2. | 17 | 17 |    |
| 14    | 1. | 49 | 5. | 15 | 7. | 19 | 7. | 28 | 5. | 36 | 2. | 09 | 16 |    |
| 15    | 1. | 57 | 5. | 20 | 7. | 22 | 7. | 26 | 5. | 30 | 2. | 01 | 15 |    |
| 16    | 2. | 04 | 5. | 26 | 7. | 24 | 7. | 24 | 5. | 24 | 1. | 53 | 14 |    |
| 17    | 2. | 12 | 5. | 32 | 7. | 26 | 7. | 22 | 5. | 18 | 1. | 45 | 13 |    |
| 18    | 2. | 19 | 5. | 37 | 7. | 28 | 7. | 20 | 5. | 12 | 1. | 37 | 12 |    |
| 19    | 2. | 27 | 5. | 42 | 7. | 30 | 7. | 18 | 5. | 06 | 1. | 25 | 11 |    |
| 20    | 2. | 34 | 5. | 48 | 7. | 31 | 7. | 15 | 5. | 00 | 1. | 21 | 10 |    |
| 21    | 2. | 42 | 5. | 53 | 7. | 33 | 7. | 12 | 4. | 54 | 1. | 13 | 9  |    |
| 22    | 2. | 49 | 5. | 58 | 7. | 34 | 7. | 10 | 4. | 48 | 1. | 05 | 8  |    |
| 23    | 2. | 56 | 6. | 03 | 7. | 35 | 7. | 07 | 4. | 41 | 0. | 57 | 7  |    |
| 24    | 3. | 03 | 6. | 07 | 7. | 36 | 7. | 04 | 4. | 35 | 0. | 49 | 6  |    |
| 25    | 3. | 11 | 6. | 12 | 7. | 37 | 7. | 00 | 4. | 28 | 0. | 41 | 5  |    |
| 26    | 3. | 18 | 6. | 17 | 7. | 38 | 6. | 57 | 4. | 22 | 0. | 33 | 4  |    |
| 27    | 3. | 25 | 6. | 21 | 7. | 39 | 6. | 54 | 4. | 15 | 0. | 24 | 3  |    |
| 28    | 3. | 32 | 6. | 26 | 7. | 40 | 6. | 50 | 4. | 08 | 0. | 16 | 2  |    |
| 29    | 3. | 39 | 6. | 30 | 7. | 40 | 6. | 46 | 4. | 01 | 0. | 08 | 1  |    |
| 30    | 3. | 46 | 6. | 34 | 7. | 40 | 6. | 42 | 3. | 54 | 0. | 00 | 0  |    |

1 11 1 10 1 9 1 8 1 7 1 6 1

Add to the Apparent Time, if the Sun's mean Anomaly be



The second Equation of Apparent Time. Subtract from the Apparent Time, If the Sun's Place be

|    | ♈  | ♉  | ♊  | ♋  | ♌  | ♍  | ♎  | ♏ |
|----|----|----|----|----|----|----|----|---|
|    | ♈  | ♉  | ♊  | ♋  | ♌  | ♍  | ♎  | ♏ |
| 0  | 00 | 00 | 08 | 24 | 08 | 46 | 30 |   |
| 1  | 00 | 00 | 08 | 35 | 08 | 36 | 29 |   |
| 2  | 00 | 40 | 08 | 45 | 08 | 25 | 28 |   |
| 3  | 01 | 00 | 08 | 54 | 08 | 14 | 27 |   |
| 4  | 01 | 19 | 09 | 03 | 08 | 01 | 26 |   |
| 5  | 01 | 39 | 09 | 11 | 07 | 49 | 25 |   |
| 6  | 01 | 59 | 09 | 18 | 07 | 35 | 24 |   |
| 7  | 02 | 18 | 09 | 25 | 07 | 21 | 23 |   |
| 8  | 02 | 37 | 09 | 31 | 07 | 06 | 22 |   |
| 9  | 02 | 57 | 09 | 36 | 06 | 51 | 21 |   |
| 10 | 03 | 16 | 09 | 41 | 06 | 35 | 20 |   |
| 11 | 03 | 34 | 09 | 45 | 06 | 19 | 19 |   |
| 12 | 03 | 53 | 09 | 49 | 06 | 02 | 18 |   |
| 13 | 04 | 11 | 09 | 51 | 05 | 45 | 17 |   |
| 14 | 04 | 29 | 09 | 53 | 05 | 27 | 16 |   |
| 15 | 04 | 47 | 09 | 55 | 05 | 09 | 15 |   |
| 16 | 05 | 04 | 09 | 55 | 04 | 50 | 14 |   |
| 17 | 05 | 21 | 09 | 55 | 08 | 31 | 13 |   |
| 18 | 05 | 38 | 09 | 54 | 04 | 12 | 12 |   |
| 19 | 05 | 54 | 09 | 52 | 03 | 52 | 11 |   |
| 20 | 06 | 10 | 09 | 50 | 03 | 32 | 10 |   |
| 21 | 06 | 26 | 09 | 47 | 03 | 12 | 9  |   |
| 22 | 06 | 41 | 09 | 43 | 02 | 51 | 8  |   |
| 23 | 06 | 55 | 09 | 38 | 02 | 30 | 7  |   |
| 24 | 07 | 10 | 09 | 33 | 02 | 09 | 6  |   |
| 25 | 07 | 23 | 09 | 27 | 01 | 48 | 5  |   |
| 26 | 07 | 36 | 09 | 20 | 01 | 27 | 4  |   |
| 27 | 07 | 49 | 09 | 13 | 01 | 05 | 2  |   |
| 28 | 08 | 01 | 09 | 05 | 00 | 43 | 1  |   |
| 29 | 08 | 13 | 08 | 56 | 00 | 22 |    |   |
| 30 | 08 | 24 | 08 | 46 | 00 | 00 | 0  |   |
|    | ♈  | ♉  | ♊  | ♋  | ♌  | ♍  | ♎  | ♏ |

Add to the Apparent Time, if the Sun's Place be

A TABLE of the mean Motion of the Earth, and of the Earth's *Perihelion*, or the Sun's *Apogee* from the Vernal Equinox.

| The Year of our Lord beginning | The Mean Motion of the Earth from the Vernal Equinox. | The Mean Motion of the Sun's <i>Apogee</i> from the Vernal Equinox. | Complete Years. | The Mean Motion of the Earth, for Complete Years | The Motion of the Sun's <i>Apogee</i> ; for Comp. Years. |
|--------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|-----------------|--------------------------------------------------|----------------------------------------------------------|
|                                | ° ' " S O ' " S O ' " S O ' " S O ' "                 |                                                                     |                 |                                                  |                                                          |
| 1701                           | 9 20 43 50                                            | 3 07 44 30                                                          | 1               | 11 29 45 40                                      | 01 03                                                    |
| 1721                           | 9 20 52 54                                            | 3 08 05 30                                                          | 2               | 11 29 31 20                                      | 02 06                                                    |
| 1741                           | 9 21 01 58                                            | 3 08 26 30                                                          | 3               | 11 29 17 00                                      | 03 09                                                    |
| 1761                           | 9 21 11 02                                            | 3 08 47 30                                                          | 4               | 00 00 01 48                                      | 04 12                                                    |
| 1781                           | 9 21 20 06                                            | 3 09 08 30                                                          | 5               | 11 29 47 28                                      | 05 15                                                    |
| 1801                           | 9 21 29 10                                            | 3 09 29 30                                                          | 6               | 11 29 33 08                                      | 06 18                                                    |
|                                |                                                       |                                                                     | 7               | 11 29 18 48                                      | 07 21                                                    |
|                                |                                                       |                                                                     | 8               | 00 00 03 36                                      | 08 24                                                    |
|                                |                                                       |                                                                     | 9               | 11 29 49 10                                      | 09 27                                                    |
|                                |                                                       |                                                                     | 10              | 11 29 34 57                                      | 10 30                                                    |
|                                | ° ' " S O ' " S O ' " S O ' " S O ' "                 |                                                                     |                 |                                                  |                                                          |
| January                        | 00 00 00 00                                           | 00 00                                                               | 1               | 11 29 20 37                                      | 11 33                                                    |
| February                       | 1 00 33 18                                            | 05                                                                  | 2               | 00 00 05 26                                      | 12 36                                                    |
| March                          | 1 28 09 11                                            | 10                                                                  | 13              | 11 29 51 06                                      | 13 39                                                    |
| April                          | 2 28 42 30                                            | 15                                                                  | 14              | 11 29 36 46                                      | 14 42                                                    |
| May                            | 3 28 16 39                                            | 20                                                                  | 15              | 11 29 22 26                                      | 15 45                                                    |
| June                           | 4 28 49 58                                            | 26                                                                  | 16              | 00 00 07 14                                      | 16 48                                                    |
| July                           | 5 28 24 08                                            | 31                                                                  | 17              | 11 29 52 54                                      | 17 51                                                    |
| August                         | 6 28 57 26                                            | 37                                                                  | 18              | 11 29 38 34                                      | 18 54                                                    |
| September                      | 7 29 30 44                                            | 42                                                                  | 19              | 11 29 24 14                                      | 19 57                                                    |
| October                        | 8 29 04 54                                            | 47                                                                  | 20              | 00 00 09 04                                      | 21 00                                                    |
| November                       | 9 29 38 12                                            | 53                                                                  |                 |                                                  |                                                          |
| December                       | 10 29 12 22                                           | 58                                                                  |                 |                                                  |                                                          |



A TABLE of the mean Motion of the Earth, for Days, Hours, Minutes.

| Days. | The mean Motion of the Earth |    |    |    | H  | d. m. s. |    |    | H  | d. m. s. |    |    |
|-------|------------------------------|----|----|----|----|----------|----|----|----|----------|----|----|
|       | s.                           | d. | m. | s. |    | m.       | s. | s. |    | m.       | s. | s. |
| 0     | 0                            | 0  | 0  | 0  | 0  | 00       | 00 | 00 | 30 | 01       | 13 | 55 |
| 1     | 0                            | 00 | 59 | 08 | 1  | 00       | 02 | 28 | 31 | 01       | 16 | 23 |
| 2     | 0                            | 01 | 58 | 17 | 2  | 00       | 04 | 56 | 32 | 01       | 18 | 51 |
| 3     | 0                            | 02 | 57 | 25 | 3  | 00       | 07 | 24 | 33 | 01       | 21 | 19 |
| 4     | 0                            | 03 | 56 | 33 | 4  | 00       | 09 | 52 | 34 | 01       | 23 | 47 |
| 5     | 0                            | 04 | 55 | 42 | 5  | 00       | 12 | 19 | 35 | 01       | 26 | 14 |
| 6     | 0                            | 05 | 54 | 50 | 6  | 00       | 14 | 47 | 36 | 01       | 28 | 42 |
| 7     | 0                            | 06 | 53 | 58 | 7  | 00       | 17 | 15 | 37 | 01       | 31 | 10 |
| 8     | 0                            | 07 | 53 | 07 | 8  | 00       | 19 | 43 | 38 | 01       | 33 | 38 |
| 9     | 0                            | 08 | 52 | 15 | 9  | 00       | 22 | 11 | 39 | 01       | 36 | 06 |
| 10    | 0                            | 09 | 51 | 23 | 10 | 00       | 24 | 39 | 40 | 01       | 38 | 34 |
| 11    | 0                            | 10 | 50 | 32 | 11 | 00       | 27 | 06 | 41 | 01       | 41 | 02 |
| 12    | 0                            | 11 | 49 | 40 | 12 | 00       | 29 | 34 | 42 | 01       | 43 | 29 |
| 13    | 0                            | 12 | 48 | 48 | 13 | 00       | 32 | 02 | 43 | 01       | 45 | 57 |
| 14    | 0                            | 13 | 47 | 57 | 14 | 00       | 34 | 30 | 44 | 01       | 48 | 25 |
| 15    | 0                            | 14 | 47 | 05 | 15 | 00       | 36 | 58 | 45 | 01       | 50 | 53 |
| 16    | 0                            | 15 | 46 | 13 | 16 | 00       | 39 | 25 | 46 | 01       | 53 | 21 |
| 17    | 0                            | 16 | 45 | 22 | 17 | 00       | 41 | 53 | 47 | 01       | 55 | 49 |
| 18    | 0                            | 17 | 44 | 30 | 18 | 00       | 44 | 21 | 48 | 01       | 58 | 16 |
| 19    | 0                            | 18 | 43 | 38 | 19 | 00       | 46 | 49 | 49 | 02       | 00 | 44 |
| 20    | 0                            | 19 | 42 | 47 | 20 | 00       | 49 | 17 | 50 | 02       | 03 | 12 |
| 21    | 0                            | 20 | 41 | 55 | 21 | 00       | 51 | 45 | 51 | 02       | 05 | 40 |
| 22    | 0                            | 21 | 41 | 03 | 22 | 00       | 54 | 13 | 52 | 02       | 08 | 08 |
| 23    | 0                            | 22 | 40 | 12 | 23 | 00       | 56 | 40 | 53 | 02       | 10 | 36 |
| 24    | 0                            | 23 | 39 | 20 | 24 | 00       | 59 | 08 | 54 | 02       | 13 | 03 |
| 25    | 0                            | 24 | 38 | 28 | 25 | 01       | 01 | 36 | 55 | 02       | 15 | 31 |
| 26    | 0                            | 25 | 37 | 37 | 26 | 01       | 04 | 04 | 56 | 02       | 17 | 59 |
| 27    | 0                            | 26 | 36 | 45 | 27 | 01       | 06 | 32 | 57 | 02       | 20 | 27 |
| 28    | 0                            | 27 | 35 | 53 | 28 | 01       | 09 | 00 | 58 | 02       | 22 | 55 |
| 29    | 0                            | 28 | 35 | 02 | 29 | 01       | 11 | 27 | 59 | 02       | 25 | 22 |
| 30    | 0                            | 29 | 34 | 10 | 30 | 01       | 13 | 55 | 60 | 02       | 28 | 50 |
| 31    | 1                            | 00 | 33 | 18 |    |          |    |    |    |          |    |    |

In LEAP-YEAR  
after *February*  
add a Day to the  
given Time, and  
with it the Mo-  
tions for a Day.

The Equation of the Earth's Orbit. *Subtract.*

| Earth's m.<br>Anomaly | Sign o    | 1        | 2        | 3        | 4        | 5        |    |
|-----------------------|-----------|----------|----------|----------|----------|----------|----|
|                       | d. m. s.  | d. m. s. | d. m. s. | d. m. s. | d. m. s. | d. m. s. |    |
|                       | 00 00 00  | 0 56 56  | 1 39 28  | 1 56 20  | 1 41 34  | 0 59 02  | 30 |
| 1                     | 0 01 58   | 0 58 39  | 1 40 28  | 1 56 20  | 1 40 33  | 0 57 14  | 29 |
| 2                     | 0 03 57   | 1 00 21  | 1 41 27  | 1 56 20  | 1 39 30  | 0 55 26  | 28 |
| 3                     | 0 05 56   | 1 02 03  | 1 42 24  | 1 56 17  | 1 38 26  | 0 53 37  | 27 |
| 4                     | 0 07 55   | 1 03 43  | 1 43 21  | 1 56 13  | 1 37 20  | 0 51 47  | 26 |
| 5                     | 0 09 54   | 1 05 22  | 1 44 15  | 1 56 04  | 1 36 11  | 0 49 55  | 25 |
| 6                     | 0 11 53   | 1 07 00  | 1 45 08  | 1 55 54  | 1 35 01  | 0 48 03  | 24 |
| 7                     | 0 13 51   | 1 08 37  | 1 45 58  | 1 55 42  | 1 33 49  | 0 46 10  | 23 |
| 8                     | 0 15 48   | 1 10 13  | 1 46 47  | 1 55 28  | 1 32 36  | 0 44 16  | 22 |
| 9                     | 0 17 46   | 1 11 48  | 1 47 33  | 1 55 12  | 1 31 20  | 0 42 21  | 21 |
| 10                    | 0 19 44   | 1 13 22  | 1 48 19  | 1 54 53  | 1 30 03  | 0 40 26  | 20 |
| 11                    | 0 21 40   | 1 14 53  | 1 49 01  | 1 54 32  | 1 28 45  | 0 38 30  | 19 |
| 12                    | 0 23 36   | 1 16 24  | 1 49 42  | 1 54 10  | 1 27 25  | 0 36 32  | 18 |
| 13                    | 0 25 33   | 1 17 53  | 1 50 22  | 1 53 46  | 1 26 03  | 0 34 34  | 17 |
| 14                    | 0 27 29   | 1 19 22  | 1 50 59  | 1 53 19  | 1 24 39  | 0 32 36  | 16 |
| 15                    | 0 29 24   | 1 20 49  | 1 51 34  | 1 52 50  | 1 23 14  | 0 30 36  | 15 |
| 16                    | 0 31 19   | 1 22 14  | 1 52 07  | 1 52 19  | 1 21 47  | 0 28 37  | 14 |
| 17                    | 0 33 13   | 1 23 38  | 1 52 38  | 1 51 46  | 1 20 19  | 0 26 37  | 13 |
| 18                    | 0 35 07   | 1 25 00  | 1 53 08  | 1 51 11  | 1 18 48  | 0 24 36  | 12 |
| 19                    | 0 37 01   | 1 26 22  | 1 53 35  | 1 50 35  | 1 17 27  | 0 22 34  | 11 |
| 20                    | 0 38 54   | 1 27 42  | 1 54 00  | 1 49 56  | 1 15 44  | 0 20 32  | 10 |
| 21                    | 0 40 44   | 1 28 58  | 1 54 23  | 1 49 14  | 1 14 10  | 0 18 30  | 9  |
| 22                    | 0 42 35   | 1 30 04  | 1 54 44  | 1 48 32  | 1 12 34  | 0 16 28  | 8  |
| 23                    | 0 44 26   | 1 31 29  | 1 55 03  | 1 47 47  | 1 10 57  | 0 14 26  | 7  |
| 24                    | 0 46 16   | 1 32 42  | 1 55 21  | 1 46 59  | 1 09 29  | 0 12 22  | 6  |
| 25                    | 0 48 05   | 1 33 54  | 1 55 35  | 1 46 10  | 1 07 39  | 0 10 19  | 5  |
| 26                    | 0 49 52   | 1 35 03  | 1 55 48  | 1 45 20  | 1 05 58  | 0 08 16  | 4  |
| 27                    | 0 51 40   | 1 36 13  | 1 55 59  | 1 44 26  | 1 04 26  | 0 06 12  | 3  |
| 28                    | 0 53 26   | 1 37 19  | 1 56 09  | 1 43 31  | 1 02 32  | 0 04 08  | 2  |
| 29                    | 0 55 11   | 1 38 24  | 1 56 15  | 1 42 34  | 1 00 48  | 0 02 04  | 1  |
| 30                    | 0 56 56   | 1 39 28  | 1 56 20  | 1 41 35  | 0 59 03  | 0 00 00  | 0  |
|                       | Sign. II. | 10       | 9        | 8        | 7        | 6        |    |

Add



# A T A B L E of the mean Motion of the M O O N, and of it's A P O G E E and N O D E.

| The Year of our Lord beginning | The Motion of the MOON, from the Vernal Equinox. | The Motion of the APOGEE, from the Vernal Equinox. | The Motion of the NODE, from the Vernal Equinox. | Complete years | The mean Motion of the MOON. | The mean Motion of the APOGEE. | The mean Motion of the NODE. |
|--------------------------------|--------------------------------------------------|----------------------------------------------------|--------------------------------------------------|----------------|------------------------------|--------------------------------|------------------------------|
|                                | S. d. m. s.                                      | S. d. m. s.                                        | S. d. m. s.                                      |                | S. d. m. s.                  | S. d. m. s.                    | S. d. m. s.                  |
| 1701                           | 10 15 19 50                                      | 11 03 13 10                                        | 04 27 24 20                                      | 1              | 04 09 23 04                  | 01 10 39 51                    | 00 19 19 43                  |
| 1721                           | 02 28 53 55                                      | 02 12 03 35                                        | 04 00 34 05                                      | 2              | 03 18 46 07                  | 02 21 19 41                    | 01 03 39 26                  |
| 1741                           | 07 12 20 00                                      | 05 15 53 50                                        | 03 03 43 51                                      | 3              | 02 28 09 10                  | 04 01 59 32                    | 01 27 59 09                  |
| 1761                           | 11 26 02 05                                      | 03 19 49 05                                        | 02 05 53 35                                      | 4              | 05 20 42 49                  | 05 12 46 04                    | 02 17 22 03                  |
| 1781                           | 04 09 36 10                                      | 11 23 39 20                                        | 01 10 03 20                                      | 5              | 10 00 05 52                  | 06 23 25 54                    | 03 06 41 46                  |
| 1801                           | 08 23 10 15                                      | 02 27 29 35                                        | 00 13 13 04                                      | 6              | 02 09 23 55                  | 08 04 05 44                    | 03 26 01 29                  |
|                                |                                                  |                                                    |                                                  | 7              | 06 18 51 59                  | 09 14 45 35                    | 04 15 21 12                  |
|                                |                                                  |                                                    |                                                  | 8              | 11 11 25 37                  | 10 25 32 07                    | 05 04 44 06                  |
|                                |                                                  |                                                    |                                                  | 9              | 03 20 48 41                  | 00 06 11 57                    | 05 24 03 49                  |
|                                |                                                  |                                                    |                                                  | 10             | 03 00 11 44                  | 01 16 51 47                    | 06 13 23 32                  |
|                                |                                                  |                                                    |                                                  | 11             | 00 09 34 48                  | 02 27 31 38                    | 07 02 43 16                  |
|                                |                                                  |                                                    |                                                  | 12             | 05 02 03 27                  | 04 03 18 10                    | 07 22 06 09                  |
|                                |                                                  |                                                    |                                                  | 13             | 09 11 31 30                  | 05 18 58 00                    | 08 11 25 52                  |
|                                |                                                  |                                                    |                                                  | 14             | 01 20 54 34                  | 06 29 37 50                    | 09 00 45 35                  |
|                                |                                                  |                                                    |                                                  | 15             | 06 17 00 37                  | 08 10 17 41                    | 09 20 05 18                  |
|                                |                                                  |                                                    |                                                  | 16             | 10 22 51 16                  | 09 21 04 13                    | 10 09 28 12                  |
|                                |                                                  |                                                    |                                                  | 17             | 03 02 14 19                  | 11 01 44 03                    | 10 28 47 56                  |
|                                |                                                  |                                                    |                                                  | 18             | 07 11 37 22                  | 00 12 23 53                    | 11 18 07 39                  |
|                                |                                                  |                                                    |                                                  | 19             | 11 21 00 26                  | 01 23 03 44                    | 00 07 27 22                  |
|                                |                                                  |                                                    |                                                  | 20             | 04 13 34 05                  | 03 03 50 15                    | 00 26 50 15                  |
| Mo.                            | Moon                                             | Apogee                                             | Node                                             |                |                              |                                |                              |
|                                | S. d. m. s.                                      | S. d. m. s.                                        | S. d. m. s.                                      |                |                              |                                |                              |
| Jan.                           | 02 00 00 09                                      | 00 00 00 00                                        | 00 00 00 00                                      |                |                              |                                |                              |
| Feb.                           | 01 18 28 06                                      | 00 03 27 13                                        | 01 38 30 00                                      |                |                              |                                |                              |
| Mar.                           | 01 27 24 26                                      | 00 06 34 23                                        | 03 07 27 00                                      |                |                              |                                |                              |
| Apr.                           | 03 15 52 32                                      | 00 10 01 36                                        | 04 45 58 00                                      |                |                              |                                |                              |
| May.                           | 04 21 10 03                                      | 00 13 23 08                                        | 06 21 17 00                                      |                |                              |                                |                              |
| June                           | 06 09 38 08                                      | 00 16 49 21                                        | 07 59 46 00                                      |                |                              |                                |                              |
| July                           | 07 14 55 39                                      | 00 20 09 54                                        | 09 35 05 00                                      |                |                              |                                |                              |
| Aug.                           | 09 03 23 44                                      | 00 23 37 06                                        | 11 13 36 00                                      |                |                              |                                |                              |
| Sept.                          | 10 21 51 50                                      | 00 27 04 20                                        | 12 52 05 00                                      |                |                              |                                |                              |
| Oct.                           | 11 27 99 10                                      | 01 00 24 52                                        | 14 27 24 00                                      |                |                              |                                |                              |
| Nov.                           | 01 15 37 26                                      | 01 03 52 05                                        | 16 05 54 00                                      |                |                              |                                |                              |
| Dec.                           | 02 20 54 37                                      | 01 07 12 37                                        | 17 41 14 00                                      |                |                              |                                |                              |

A TABLE of the mean Motion of the MOON, for Days.

| Days. | The mean Motion<br>of the MOON. |    |    |    | The mean Motion<br>of the APOGEE. |    |    | The mean Motion<br>of the NODE. |    |    |
|-------|---------------------------------|----|----|----|-----------------------------------|----|----|---------------------------------|----|----|
|       | S.                              | d. | m. | s. | d.                                | m. | s. | d.                              | m. | s. |
| 1     | 00                              | 13 | 10 | 35 | 00                                | 06 | 41 | 00                              | 03 | 11 |
| 2     | 00                              | 26 | 21 | 10 | 00                                | 13 | 22 | 00                              | 06 | 21 |
| 3     | 01                              | 09 | 31 | 45 | 00                                | 20 | 03 | 00                              | 09 | 32 |
| 4     | 01                              | 22 | 42 | 20 | 00                                | 26 | 44 | 00                              | 12 | 43 |
| 5     | 02                              | 05 | 52 | 55 | 00                                | 33 | 25 | 00                              | 15 | 53 |
| 6     | 02                              | 19 | 03 | 30 | 00                                | 40 | 06 | 00                              | 19 | 04 |
| 7     | 03                              | 02 | 14 | 10 | 00                                | 46 | 48 | 00                              | 22 | 14 |
| 8     | 03                              | 15 | 24 | 40 | 00                                | 53 | 29 | 00                              | 25 | 25 |
| 9     | 03                              | 28 | 35 | 15 | 01                                | 00 | 10 | 00                              | 28 | 36 |
| 10    | 04                              | 11 | 45 | 50 | 01                                | 06 | 51 | 00                              | 31 | 46 |
| 11    | 04                              | 24 | 56 | 25 | 01                                | 13 | 32 | 00                              | 34 | 57 |
| 12    | 05                              | 08 | 07 | 00 | 01                                | 20 | 13 | 00                              | 38 | 08 |
| 13    | 05                              | 21 | 17 | 35 | 01                                | 26 | 54 | 00                              | 41 | 18 |
| 14    | 06                              | 04 | 28 | 10 | 01                                | 33 | 35 | 00                              | 44 | 29 |
| 15    | 06                              | 17 | 38 | 45 | 01                                | 40 | 16 | 00                              | 47 | 40 |
| 16    | 07                              | 00 | 49 | 20 | 01                                | 46 | 57 | 00                              | 50 | 50 |
| 17    | 07                              | 13 | 59 | 55 | 01                                | 53 | 38 | 00                              | 54 | 01 |
| 18    | 07                              | 27 | 10 | 30 | 02                                | 00 | 19 | 00                              | 57 | 11 |
| 19    | 08                              | 10 | 21 | 05 | 02                                | 07 | 00 | 01                              | 00 | 22 |
| 20    | 08                              | 23 | 31 | 40 | 02                                | 13 | 41 | 01                              | 03 | 33 |
| 21    | 09                              | 06 | 42 | 15 | 02                                | 20 | 23 | 01                              | 06 | 43 |
| 22    | 09                              | 19 | 52 | 50 | 02                                | 27 | 04 | 01                              | 09 | 54 |
| 23    | 10                              | 03 | 03 | 25 | 02                                | 33 | 45 | 01                              | 13 | 05 |
| 24    | 10                              | 16 | 14 | 00 | 02                                | 40 | 26 | 01                              | 16 | 15 |
| 25    | 10                              | 29 | 24 | 35 | 02                                | 47 | 07 | 01                              | 19 | 26 |
| 26    | 11                              | 12 | 35 | 10 | 02                                | 53 | 48 | 01                              | 22 | 37 |
| 27    | 11                              | 25 | 45 | 45 | 03                                | 00 | 29 | 01                              | 25 | 47 |
| 28    | 00                              | 08 | 56 | 20 | 03                                | 07 | 10 | 01                              | 28 | 58 |
| 29    | 00                              | 22 | 06 | 55 | 03                                | 13 | 51 | 01                              | 32 | 09 |
| 30    | 01                              | 05 | 17 | 31 | 03                                | 20 | 32 | 01                              | 35 | 19 |
| 31    | 01                              | 18 | 28 | 06 | 03                                | 27 | 13 | 01                              | 38 | 30 |



A TABLE of the mean Motion of the MOON in Hours, and Parts of an Hour.

| H. | d. | m. | s. | m. | s. | m. | s. | H. | d. | m. | s. | m. | s. | m. | s. |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| m. | m. | s. | s. | s. | s. | s. | s. | m. | m. | s. | s. | s. | s. | s. | s. |
| s. | s. | m. | m. | m. | m. | m. | m. | s. | s. | s. | s. | s. | s. | s. | s. |
| —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  | —  |
| 0  | 0  | 00 | 00 | 0  | 00 | 0  | 00 | 30 | 16 | 28 | 14 | 8  | 21 | 3  | 58 |
| 1  | 0  | 32 | 56 | 0  | 17 | 0  | 08 | 31 | 17 | 01 | 10 | 8  | 38 | 4  | 06 |
| 2  | 1  | 05 | 53 | 0  | 33 | 0  | 16 | 32 | 17 | 34 | 07 | 8  | 54 | 4  | 14 |
| 3  | 1  | 38 | 49 | 0  | 50 | 0  | 24 | 33 | 18 | 07 | 03 | 9  | 11 | 4  | 22 |
| 4  | 2  | 11 | 46 | 1  | 07 | 0  | 32 | 34 | 18 | 39 | 59 | 9  | 28 | 4  | 30 |
| 5  | 2  | 44 | 42 | 1  | 24 | 0  | 40 | 35 | 19 | 12 | 55 | 9  | 45 | 4  | 38 |
| 6  | 3  | 17 | 39 | 1  | 40 | 0  | 48 | 36 | 19 | 45 | 52 | 10 | 02 | 4  | 46 |
| 7  | 3  | 50 | 35 | 1  | 57 | 0  | 56 | 37 | 20 | 18 | 48 | 10 | 19 | 4  | 54 |
| 8  | 4  | 23 | 32 | 2  | 14 | 1  | 04 | 38 | 20 | 51 | 45 | 10 | 36 | 5  | 02 |
| 9  | 4  | 56 | 28 | 2  | 30 | 1  | 12 | 39 | 21 | 24 | 41 | 10 | 52 | 5  | 10 |
| 10 | 5  | 29 | 25 | 2  | 47 | 1  | 19 | 40 | 21 | 57 | 38 | 11 | 08 | 5  | 18 |
| 11 | 6  | 02 | 21 | 3  | 04 | 1  | 27 | 41 | 22 | 30 | 34 | 11 | 25 | 5  | 26 |
| 12 | 6  | 35 | 18 | 3  | 21 | 1  | 35 | 42 | 23 | 03 | 31 | 11 | 42 | 5  | 34 |
| 13 | 7  | 08 | 14 | 3  | 37 | 1  | 43 | 43 | 23 | 36 | 27 | 11 | 59 | 5  | 42 |
| 14 | 7  | 41 | 10 | 3  | 54 | 1  | 51 | 44 | 24 | 09 | 24 | 12 | 16 | 5  | 50 |
| 15 | 8  | 14 | 07 | 4  | 11 | 1  | 59 | 45 | 24 | 42 | 20 | 12 | 32 | 5  | 58 |
| 16 | 8  | 47 | 03 | 4  | 27 | 2  | 07 | 46 | 25 | 15 | 17 | 12 | 48 | 6  | 06 |
| 17 | 9  | 20 | 00 | 4  | 44 | 2  | 15 | 47 | 25 | 48 | 13 | 13 | 05 | 6  | 14 |
| 18 | 9  | 52 | 56 | 5  | 01 | 2  | 23 | 48 | 26 | 21 | 10 | 13 | 22 | 6  | 22 |
| 19 | 10 | 25 | 53 | 5  | 18 | 2  | 31 | 49 | 26 | 54 | 06 | 13 | 39 | 6  | 30 |
| 20 | 10 | 58 | 49 | 5  | 34 | 2  | 39 | 50 | 27 | 27 | 03 | 13 | 56 | 6  | 38 |
| 21 | 11 | 31 | 46 | 5  | 51 | 2  | 47 | 51 | 27 | 59 | 59 | 14 | 13 | 6  | 46 |
| 22 | 12 | 04 | 42 | 6  | 08 | 2  | 55 | 52 | 28 | 32 | 56 | 14 | 30 | 6  | 54 |
| 23 | 12 | 37 | 39 | 6  | 24 | 3  | 03 | 53 | 29 | 05 | 52 | 14 | 46 | 7  | 01 |
| 24 | 13 | 10 | 35 | 6  | 41 | 3  | 11 | 54 | 29 | 38 | 49 | 15 | 02 | 7  | 08 |
| 25 | 13 | 43 | 32 | 6  | 58 | 3  | 19 | 55 | 30 | 11 | 45 | 15 | 19 | 7  | 16 |
| 26 | 14 | 16 | 28 | 7  | 15 | 3  | 27 | 56 | 30 | 44 | 42 | 15 | 36 | 7  | 24 |
| 27 | 14 | 49 | 24 | 7  | 31 | 3  | 34 | 57 | 31 | 17 | 38 | 15 | 53 | 7  | 32 |
| 28 | 15 | 22 | 21 | 7  | 48 | 3  | 42 | 58 | 31 | 50 | 34 | 16 | 10 | 7  | 40 |
| 29 | 15 | 55 | 17 | 8  | 05 | 3  | 50 | 59 | 32 | 23 | 31 | 16 | 26 | 7  | 48 |
| 30 | 16 | 28 | 14 | 8  | 21 | 3  | 58 | 60 | 32 | 56 | 27 | 16 | 43 | 7  | 56 |

A TABLE of the Moon's Second Equation, being the Logarithms answering to the SUN's Distance from the Moon's *Apogee* in the Octants, &c.

| S. | o  |          | o  | S. |
|----|----|----------|----|----|
| 1  | 00 | 2.330414 | 00 | 12 |
| 1  | 15 | 2.333447 | 15 | 11 |
| 1  | 00 | 2.336460 | 00 | 10 |
| 1  | 15 | 2.339451 | 15 | 9  |
| 2  | 00 | 2.342423 | 00 | 8  |
| 1  | 15 | 2.346353 | 15 | 7  |
| 3  | 00 | 2.350248 | 00 | 6  |
| 1  | 15 | 2.354108 | 15 |    |
| 4  | 00 | 2.357935 | 00 |    |
| 1  | 15 | 2.361728 | 15 |    |
| 5  | 00 | 2.365488 | 00 |    |
| 1  | 15 | 2.369216 | 15 |    |
| 6  | 00 | 2.372912 | 00 |    |

Mr. FLAMSTEED's Table of Refractions.

| Dist. from<br>the <i>Vertex</i> . | Ref. |    | Dist.<br>a <i>Vt.</i> | Ref. |
|-----------------------------------|------|----|-----------------------|------|
| Degrees.                          | m.   | s. | Deg                   | m.s. |
| 90                                | 33   | 00 | 65                    | 1 45 |
| 89 $\frac{1}{2}$                  | 26   | 38 | 64                    | 1 40 |
| 89 $\frac{1}{2}$                  | 23   | 22 | 63                    | 1 36 |
| 88 $\frac{1}{2}$                  | 20   | 17 | 62                    | 1 31 |
| 88 $\frac{1}{2}$                  | 17   | 26 | 62                    | 1 27 |
| 87 $\frac{1}{2}$                  | 15   | 15 | 60                    | 1 23 |
| 87 $\frac{1}{2}$                  | 13   | 23 | 59                    | 1 20 |
| 86 $\frac{1}{2}$                  | 11   | 53 | 58                    | 1 17 |
| 86 $\frac{1}{2}$                  | 10   | 39 | 57                    | 1 14 |
| 85 $\frac{1}{2}$                  | 9    | 38 | 56                    | 1 11 |
| 85                                | 8    | 48 | 55                    | 1 09 |
| 84                                | 7    | 26 | 54                    | 1 07 |
| 83                                | 6    | 25 | 53                    | 1 05 |
| 82                                | 5    | 37 | 52                    | 1 02 |
| 81                                | 5    | 02 | 51                    | 0 00 |
| 80                                | 4    | 33 | 50                    | 0 58 |
| 79                                | 4    | 06 | 49                    | 0 56 |
| 78                                | 3    | 45 | 48                    | 0 54 |
| 77                                | 3    | 29 | 47                    | 0 52 |
| 76                                | 3    | 13 | 46                    | 0 50 |
| 75                                | 3    | 00 | 45                    | 0 48 |
| 74                                | 2    | 48 | 44                    | 0 46 |
| 73                                | 2    | 38 | 43                    | 0 45 |
| 72                                | 2    | 29 | 42                    | 0 44 |
| 71                                | 2    | 21 | 41                    | 0 42 |
| 70                                | 2    | 14 | 40                    | 0 40 |
| 69                                | 2    | 07 | 35                    | 0 34 |
| 68                                | 2    | 01 | 30                    | 0 29 |
| 67                                | 1    | 55 | 20                    | 0 19 |
| 66                                | 1    | 50 | 10                    | 0 09 |
| 65                                | 1    | 45 | 00                    | 0 00 |



The Equations of the Moon's *Apogee*; and the *Excentricities* of it's *Orbit*,  
in such Parts as the *Radius* contains 1000000.

Add the Equations of the *Apogee*.

| Annual Argu. | Sign $\frac{0}{6}$  | Excentri-<br>city. | Sign $\frac{1}{7}$  | Excentri-<br>city. | Sign $\frac{2}{8}$ | Excentri-<br>city. | Annual Argu. |
|--------------|---------------------|--------------------|---------------------|--------------------|--------------------|--------------------|--------------|
|              | d. m. s.            | Parts.             | d. m. s.            | Parts.             | d. m. s.           | Parts.             |              |
| 10           | 0 00 00             | 61946              | 9 25 59             | 57286              | 11 37 01           | 46720              | 30           |
| 10           | 0 21 01             | 61916              | 9 40 10             | 56891              | 11 27 42           | 46542              | 29           |
| 2            | 0 42 00             | 61881              | 9 53 53             | 56491              | 11 17 17           | 46391              | 28           |
| 3            | 1 02 57             | 61840              | 10 07 05            | 56086              | 11 05 49           | 46257              | 27           |
| 4            | 1 23 53             | 61795              | 10 19 46            | 55676              | 10 53 15           | 46133              | 26           |
| 5            | 1 44 45             | 61744              | 10 31 54            | 55261              | 10 39 36           | 46019              | 25           |
| 6            | 2 05 33             | 61659              | 10 43 28            | 54841              | 10 24 51           | 45915              | 24           |
| 7            | 2 26 16             | 61607              | 10 54 27            | 54416              | 10 09 01           | 45821              | 23           |
| 8            | 2 46 53             | 61532              | 11 04 50            | 53984              | 9 52 06            | 45737              | 22           |
| 9            | 3 07 23             | 61450              | 11 14 36            | 53545              | 9 34 06            | 45663              | 21           |
| 10           | 3 27 42             | 61371              | 11 23 43            | 53097              | 9 15 03            | 45591              | 20           |
| 11           | 3 48 01             | 61270              | 11 32 09            | 52648              | 8 54 21            | 45520              | 19           |
| 12           | 4 08 06             | 61159              | 11 39 57            | 52198              | 8 33 41            | 45450              | 18           |
| 13           | 4 28 01             | 61038              | 11 46 57            | 51766              | 8 11 38            | 45381              | 17           |
| 14           | 4 47 46             | 60907              | 11 53 16            | 51357              | 7 48 29            | 45310              | 16           |
| 15           | 5 07 18             | 60766              | 11 58 49            | 50975              | 7 24 22            | 45118              | 15           |
| 16           | 5 26 38             | 60615              | 12 03 36            | 50623              | 6 59 20            | 44926              | 14           |
| 17           | 5 45 49             | 60454              | 12 07 35            | 50302              | 6 33 25            | 44734              | 13           |
| 18           | 6 04 35             | 60283              | 12 10 44            | 50011              | 6 06 40            | 44542              | 12           |
| 19           | 6 23 55             | 60102              | 12 13 03            | 49730              | 5 39 06            | 44350              | 11           |
| 20           | 6 41 30             | 59912              | 12 14 30            | 49462              | 5 10 47            | 44158              | 10           |
| 21           | 6 59 32             | 59713              | 12 15 04            | 49191              | 4 41 47            | 43986              | 9            |
| 22           | 7 17 16             | 59502              | 12 14 43            | 48903              | 4 11 16            | 43840              | 8            |
| 23           | 7 34 40             | 59292              | 12 13 27            | 48610              | 3 41 56            | 43734              | 7            |
| 24           | 7 51 44             | 59250              | 12 11 14            | 48316              | 3 11 12            | 43647              | 6            |
| 25           | 8 08 26             | 58982              | 12 08 03            | 48006              | 2 40 01            | 43570              | 5            |
| 26           | 8 24 46             | 58681              | 12 03 53            | 47713              | 2 08 28            | 43504              | 4            |
| 27           | 8 40 43             | 58364              | 11 58 43            | 47442              | 1 36 37            | 43447              | 3            |
| 28           | 8 56 15             | 58023              | 11 52 31            | 47171              | 1 04 33            | 43400              | 2            |
| 29           | 9 11 20             | 57665              | 11 45 18            | 46930              | 0 32 19            | 43356              | 1            |
| 30           | 9 25 59             | 57286              | 11 37 01            | 46720              | 0 00 00            | 43319              | 0            |
|              | Sign $\frac{5}{11}$ |                    | Sign $\frac{4}{10}$ |                    | Sign $\frac{3}{9}$ |                    |              |

Subtract the Equations of the *Apogee*.

[illegible]



# A TABLE of the Equation of the NODE and Inclination of the LIMIT above 5°.

Add the Equations of the NODE.

| Sun's Diff. fr. Node. | Sign $\frac{0}{6}$ |                 | Sign $\frac{1}{7}$  |                 | Sign $\frac{2}{8}$ |                 | Sun's Diff. fr. Node. |
|-----------------------|--------------------|-----------------|---------------------|-----------------|--------------------|-----------------|-----------------------|
|                       | Equat. NODE.       | Incl. of LIMIT. | Equat. NODE.        | Incl. of LIMIT. | Equat. NODE.       | Incl. of LIMIT. |                       |
|                       | D. M. S.           | M. S.           | D. M. S.            | M. S.           | D. M. S.           | M. S.           |                       |
| 0                     | 00 00              | 18 00           | 1 16 33             | 13 30           | 1 18 41            | 04 30           | 30                    |
| 1                     | 03 03              | 18 00           | 1 18 09             | 13 14           | 1 17 07            | 04 14           | 29                    |
| 2                     | 06 06              | 17 59           | 1 59 41             | 12 57           | 1 15 26            | 03 59           | 28                    |
| 3                     | 09 08              | 17 59           | 1 21 01             | 12 40           | 1 13 42            | 03 43           | 27                    |
| 4                     | 12 10              | 17 55           | 1 22 20             | 12 23           | 1 11 49            | 03 28           | 26                    |
| 5                     | 15 10              | 17 52           | 1 23 34             | 12 05           | 1 09 53            | 03 13           | 25                    |
| 6                     | 18 11              | 17 48           | 1 24 47             | 11 47           | 1 07 49            | 02 59           | 24                    |
| 7                     | 21 09              | 17 43           | 1 25 38             | 11 29           | 1 05 34            | 02 45           | 23                    |
| 8                     | 24 07              | 17 38           | 1 26 28             | 11 11           | 1 03 29            | 02 32           | 22                    |
| 9                     | 26 57              | 17 34           | 1 27 12             | 10 53           | 1 00 44            | 02 19           | 21                    |
| 10                    | 29 56              | 17 28           | 1 27 54             | 10 34           | 0 57 49            | 02 06           | 20                    |
| 11                    | 32 47              | 17 21           | 1 28 25             | 10 14           | 0 55 56            | 01 54           | 19                    |
| 12                    | 35 38              | 17 13           | 1 28 56             | 09 55           | 0 53 51            | 01 43           | 18                    |
| 13                    | 38 23              | 17 05           | 1 29 14             | 09 37           | 0 51 18            | 01 32           | 17                    |
| 14                    | 41 09              | 16 57           | 1 29 31             | 09 18           | 0 48 36            | 01 22           | 16                    |
| 15                    | 43 50              | 16 48           | 1 29 40             | 09 00           | 0 45 56            | 01 12           | 15                    |
| 16                    | 46 30              | 16 38           | 1 29 41             | 08 42           | 0 43 06            | 01 03           | 14                    |
| 17                    | 49 03              | 16 28           | 1 29 36             | 08 23           | 0 40 18            | 00 55           | 13                    |
| 18                    | 51 37              | 16 17           | 1 29 25             | 08 05           | 0 37 22            | 00 47           | 12                    |
| 19                    | 54 04              | 16 06           | 1 29 05             | 07 46           | 0 34 30            | 00 39           | 11                    |
| 20                    | 56 31              | 15 54           | 1 28 42             | 07 26           | 0 31 27            | 00 32           | 10                    |
| 21                    | 58 51              | 15 41           | 1 28 10             | 07 07           | 0 28 30            | 00 26           | 9                     |
| 22                    | 01 09              | 15 28           | 1 27 33             | 06 49           | 0 25 21            | 00 22           | 8                     |
| 23                    | 03 21              | 15 15           | 1 26 48             | 06 31           | 0 22 26            | 00 17           | 7                     |
| 24                    | 05 30              | 15 01           | 1 25 58             | 06 13           | 0 19 18            | 00 12           | 6                     |
| 25                    | 07 32              | 14 47           | 1 25 00             | 05 55           | 0 16 12            | 00 08           | 5                     |
| 26                    | 09 32              | 14 32           | 1 23 57             | 05 37           | 0 12 54            | 00 05           | 4                     |
| 27                    | 11 24              | 14 17           | 1 22 47             | 05 20           | 0 09 38            | 00 03           | 3                     |
| 28                    | 13 16              | 14 01           | 1 21 31             | 05 03           | 0 06 11            | 00 01           | 2                     |
| 29                    | 14 56              | 13 46           | 1 20 09             | 04 46           | 0 03 06            | 00 00           | 1                     |
| 30                    | 16 33              | 13 30           | 1 18 41             | 04 30           | 0 00 00            | 00 00           | 0                     |
| Sign $\frac{5}{11}$   |                    |                 | Sign $\frac{4}{10}$ |                 | Sign $\frac{3}{9}$ |                 |                       |

Subtract the Equations of the NODE.

D

A TABLE of the *Reduction* fitted to the least *Inclination* of the Orbit of  $5^{\circ}$  with the *Excess* fitted to the greatest *Inclination* of  $5^{\circ} 18'$ .

| Argum.<br>Lat. 10 | Sig. $\frac{5}{6}$ Subt. |                | Excesses<br>S. | Argum.<br>Lat. 10 | Sig. $\frac{5}{7}$ Subt. |                | Excesses<br>S. | Argum.<br>Lat. 10 | Sig. $\frac{3}{8}$ Subt. |               | Excesses<br>S. | Argum.<br>Lat. 10 |
|-------------------|--------------------------|----------------|----------------|-------------------|--------------------------|----------------|----------------|-------------------|--------------------------|---------------|----------------|-------------------|
|                   | Reduction.               |                |                |                   | Reduction                |                |                |                   | Reduction                |               |                |                   |
|                   | M.                       | S.             |                |                   | M.                       | S.             |                |                   | M.                       | S.            |                |                   |
| 1                 | 00                       | 00             | 00             | 1                 | 05                       | 40             | 42             | 1                 | 05                       | 41            | 42             | 30                |
| 2                 | 00                       | 14             | 02             | 2                 | 05                       | 47             | 43             | 2                 | 05                       | 34            | 41             | 29                |
| 3                 | 00                       | 27             | 04             | 3                 | 05                       | 53             | 44             | 3                 | 05                       | 26            | 40             | 28                |
| 4                 | 00                       | 41             | 06             | 4                 | 05                       | 59             | 45             | 4                 | 05                       | 18            | 39             | 27                |
| 5                 | 00                       | 55             | 08             | 5                 | 06                       | 04             | 46             | 5                 | 05                       | 10            | 38             | 26                |
| 6                 | 01                       | 08             | 09             | 6                 | 06                       | 09             | 46             | 6                 | 05                       | 02            | 37             | 25                |
| 7                 | 01                       | 22             | 11             | 7                 | 06                       | 14             | 46             | 7                 | 04                       | 53            | 36             | 24                |
| 8                 | 01                       | 35             | 12             | 8                 | 06                       | 18             | 47             | 8                 | 04                       | 43            | 35             | 23                |
| 9                 | 01                       | 48             | 13             | 9                 | 06                       | 21             | 47             | 9                 | 04                       | 34            | 34             | 22                |
| 10                | 02                       | 01             | 15             | 10                | 06                       | 24             | 47             | 10                | 04                       | 23            | 33             | 21                |
| 11                | 02                       | 14             | 17             | 11                | 06                       | 27             | 48             | 11                | 04                       | 13            | 31             | 20                |
| 12                | 02                       | 27             | 19             | 12                | 06                       | 29             | 48             | 12                | 04                       | 02            | 30             | 19                |
| 13                | 02                       | 40             | 20             | 13                | 06                       | 31             | 48             | 13                | 03                       | 51            | 29             | 18                |
| 14                | 02                       | 52             | 22             | 14                | 06                       | 32             | 48             | 14                | 03                       | 40            | 28             | 17                |
| 15                | 03                       | 04             | 23             | 15                | 06                       | 33             | 49             | 15                | 03                       | 29            | 26             | 16                |
| 16                | 03                       | 16             | 24             | 16                | 06                       | 33             | 49             | 16                | 03                       | 17            | 24             | 15                |
| 17                | 03                       | 28             | 26             | 17                | 06                       | 33             | 49             | 17                | 03                       | 05            | 23             | 14                |
| 18                | 03                       | 40             | 28             | 18                | 06                       | 32             | 49             | 18                | 02                       | 53            | 22             | 13                |
| 19                | 03                       | 51             | 29             | 19                | 06                       | 31             | 49             | 19                | 02                       | 40            | 20             | 12                |
| 20                | 04                       | 02             | 30             | 20                | 06                       | 29             | 48             | 20                | 02                       | 28            | 19             | 11                |
| 21                | 04                       | 12             | 31             | 21                | 06                       | 27             | 48             | 21                | 02                       | 15            | 17             | 10                |
| 22                | 04                       | 23             | 33             | 22                | 06                       | 25             | 47             | 22                | 02                       | 02            | 15             | 9                 |
| 23                | 04                       | 33             | 34             | 23                | 06                       | 22             | 47             | 23                | 01                       | 49            | 13             | 8                 |
| 24                | 04                       | 44             | 35             | 24                | 06                       | 18             | 47             | 24                | 01                       | 35            | 12             | 7                 |
| 25                | 04                       | 52             | 36             | 25                | 06                       | 14             | 46             | 25                | 01                       | 22            | 11             | 6                 |
| 26                | 05                       | 01             | 37             | 26                | 06                       | 10             | 46             | 26                | 01                       | 08            | 09             | 5                 |
| 27                | 05                       | 09             | 38             | 27                | 06                       | 05             | 46             | 27                | 00                       | 55            | 08             | 4                 |
| 28                | 05                       | 18             | 39             | 28                | 06                       | 00             | 45             | 28                | 00                       | 41            | 06             | 3                 |
| 29                | 05                       | 26             | 40             | 29                | 05                       | 54             | 44             | 29                | 00                       | 27            | 04             | 2                 |
| 30                | 05                       | 33             | 41             | 30                | 05                       | 47             | 43             | 30                | 00                       | 14            | 02             | 1                 |
| 31                | 05                       | 40             | 42             | 31                | 05                       | 41             | 42             | 31                | 00                       | 00            | 00             | 0                 |
|                   | Sign                     | $\frac{5}{11}$ |                |                   | Sign                     | $\frac{4}{10}$ |                |                   | Sign                     | $\frac{3}{9}$ |                |                   |



Of course, with the Excel fitted to the greatest

|                 |             |         |             |          |       |                 |              |         |          |          |       |                 |              |        |          |          |       |
|-----------------|-------------|---------|-------------|----------|-------|-----------------|--------------|---------|----------|----------|-------|-----------------|--------------|--------|----------|----------|-------|
| Argum. Lat. 101 | Sign 6 Nor. | 6 Sou.  | Moon's Lat. | D. M. S. | M. S. | Argum. Lat. 101 | Sign 7 Nor.  | 7 Sou.  | M's Lat. | D. M. S. | M. S. | Argum. Lat. 101 | Sign 8 Nor.  | 8 Sou. | M's Lat. | D. M. S. | M. S. |
| 1               |             |         | 0 00 00     | 00 00    |       | 1               |              |         | 2 29 51  | 09 00    |       | 1               |              |        | 4 19 44  | 15 36    |       |
| 2               |             |         | 0 05 14     | 00 19    |       | 2               |              |         | 2 34 22  | 09 16    |       | 2               |              |        | 4 22 18  | 15 35    |       |
| 3               |             |         | 0 10 28     | 00 37    |       | 3               |              |         | 2 38 50  | 09 32    |       | 3               |              |        | 4 24 49  | 15 54    |       |
| 4               |             |         | 0 15 42     | 00 56    |       | 4               |              |         | 2 43 15  | 09 48    |       | 4               |              |        | 4 27 14  | 16 02    |       |
| 5               |             |         | 0 20 55     | 01 15    |       | 5               |              |         | 2 47 37  | 10 03    |       | 5               |              |        | 4 29 34  | 16 11    |       |
| 6               |             |         | 0 26 08     | 01 34    |       | 6               |              |         | 2 51 56  | 10 19    |       | 6               |              |        | 4 31 50  | 16 19    |       |
| 7               |             |         | 0 31 20     | 01 53    |       | 7               |              |         | 2 56 11  | 10 34    |       | 7               |              |        | 4 34 00  | 16 27    |       |
| 8               |             |         | 0 36 32     | 02 11    |       | 8               |              |         | 3 00 24  | 10 49    |       | 8               |              |        | 4 36 06  | 16 34    |       |
| 9               |             |         | 0 41 43     | 02 30    |       | 9               |              |         | 3 04 33  | 11 04    |       | 9               |              |        | 4 38 06  | 16 42    |       |
| 10              |             |         | 0 46 53     | 02 49    |       | 10              |              |         | 3 08 39  | 11 19    |       | 10              |              |        | 4 40 02  | 16 49    |       |
| 11              |             |         | 0 52 02     | 03 08    |       | 11              |              |         | 3 12 42  | 11 34    |       | 11              |              |        | 4 41 52  | 16 55    |       |
| 12              |             |         | 0 57 10     | 03 26    |       | 12              |              |         | 3 16 41  | 11 48    |       | 12              |              |        | 4 43 37  | 17 01    |       |
| 13              |             |         | 1 02 18     | 03 45    |       | 13              |              |         | 3 20 36  | 12 02    |       | 13              |              |        | 4 45 17  | 17 07    |       |
| 14              |             |         | 1 07 24     | 04 03    |       | 14              |              |         | 3 24 38  | 12 16    |       | 14              |              |        | 4 46 52  | 17 12    |       |
| 15              |             |         | 1 12 29     | 04 21    |       | 15              |              |         | 3 28 16  | 12 30    |       | 15              |              |        | 4 48 21  | 17 18    |       |
| 16              |             |         | 1 17 33     | 04 39    |       | 16              |              |         | 3 32 00  | 12 44    |       | 16              |              |        | 4 49 45  | 17 23    |       |
| 17              |             |         | 1 22 36     | 04 57    |       | 17              |              |         | 3 35 40  | 12 56    |       | 17              |              |        | 4 51 04  | 17 28    |       |
| 18              |             |         | 1 27 37     | 05 15    |       | 18              |              |         | 3 39 17  | 13 09    |       | 18              |              |        | 4 52 18  | 17 33    |       |
| 19              |             |         | 1 32 36     | 05 33    |       | 19              |              |         | 3 42 49  | 13 22    |       | 19              |              |        | 4 53 26  | 17 37    |       |
| 20              |             |         | 1 37 34     | 05 51    |       | 20              |              |         | 3 46 17  | 13 35    |       | 20              |              |        | 4 54 28  | 17 40    |       |
| 21              |             |         | 1 42 29     | 06 09    |       | 21              |              |         | 3 49 42  | 13 47    |       | 21              |              |        | 4 55 26  | 17 44    |       |
| 22              |             |         | 1 47 23     | 06 27    |       | 22              |              |         | 3 53 02  | 13 59    |       | 22              |              |        | 4 56 18  | 17 47    |       |
| 23              |             |         | 1 52 16     | 06 45    |       | 23              |              |         | 3 56 17  | 14 11    |       | 23              |              |        | 4 57 04  | 17 50    |       |
| 24              |             |         | 1 57 06     | 07 02    |       | 24              |              |         | 3 59 29  | 14 23    |       | 24              |              |        | 4 57 45  | 17 52    |       |
| 25              |             |         | 2 01 54     | 07 19    |       | 25              |              |         | 4 02 36  | 14 34    |       | 25              |              |        | 4 58 21  | 17 54    |       |
| 26              |             |         | 2 06 39     | 07 36    |       | 26              |              |         | 4 05 39  | 14 45    |       | 26              |              |        | 4 58 51  | 17 56    |       |
| 27              |             |         | 2 11 23     | 07 53    |       | 27              |              |         | 4 08 37  | 14 56    |       | 27              |              |        | 4 59 16  | 17 58    |       |
| 28              |             |         | 2 16 04     | 08 09    |       | 28              |              |         | 4 11 30  | 15 06    |       | 28              |              |        | 4 59 35  | 17 59    |       |
| 29              |             |         | 2 20 42     | 08 26    |       | 29              |              |         | 4 14 19  | 15 17    |       | 29              |              |        | 4 59 49  | 17 59    |       |
| 30              |             |         | 2 25 18     | 08 43    |       | 30              |              |         | 4 17 04  | 15 26    |       | 30              |              |        | 4 59 57  | 18 00    |       |
| 31              |             |         | 2 29 51     | 09 00    |       | 31              |              |         | 4 19 44  | 15 36    |       | 31              |              |        | 5 00 00  | 18 00    |       |
|                 | Sign 9 Nor. | 11 Sou. |             |          |       |                 | Sign 10 Nor. | 10 Sou. |          |          |       |                 | Sign 11 Nor. | 9 Sou. |          |          |       |

**A TABLE of the true Horary Motion of the Moon in Eclipses, fitted to the least and greatest Eccentricities, with the true Horary Motion of the SUN or EARTH, and the SUN's Semidiameter.**

| Mean Anom. | The true Horary Mo. of the Earth | Semidiameter of the SUN. | The true Horary Motion of the Moon.        | Mean Anom. |
|------------|----------------------------------|--------------------------|--------------------------------------------|------------|
| S. O.      | M. S.                            | M. s.                    | Excentricities: Least M. S. Greatest M. S. | S. O.      |
| 0 00       | 2 23                             | 15 50                    | 31 27 30 26                                | 12 00 51   |
| 06         | 2 23                             | 15 50                    | 31 29 30 27                                | 24         |
| 12         | 2 23                             | 15 50                    | 31 32 30 29                                | 18         |
| 18         | 2 23                             | 15 50                    | 31 34 30 32                                | 12         |
| 24         | 2 23                             | 15 51                    | 31 38 30 36                                | 06         |
| 00         | 2 23                             | 15 52                    | 31 44 30 41                                | 00         |
| 06         | 2 24                             | 15 53                    | 31 50 30 48                                | 24         |
| 12         | 3 24                             | 15 54                    | 31 57 30 58                                | 18         |
| 18         | 2 24                             | 15 55                    | 32 05 31 10                                | 12         |
| 24         | 2 25                             | 15 56                    | 32 14 31 24                                | 06         |
| 00         | 2 25                             | 15 58                    | 32 24 31 40                                | 00         |
| 06         | 2 25                             | 15 59                    | 32 35 32 04                                | 24         |
| 12         | 2 26                             | 16 01                    | 32 47 32 24                                | 18         |
| 18         | 2 27                             | 16 02                    | 33 01 33 47                                | 12         |
| 24         | 2 27                             | 16 04                    | 33 16 33 08                                | 06         |
| 00         | 2 28                             | 16 06                    | 33 33 33 33                                | 00         |
| 06         | 2 28                             | 16 08                    | 33 47 33 54                                | 24         |
| 12         | 2 29                             | 16 09                    | 34 00 34 14                                | 18         |
| 18         | 2 29                             | 16 11                    | 34 12 34 32                                | 12         |
| 24         | 2 30                             | 16 13                    | 34 24 34 50                                | 06         |
| 00         | 2 30                             | 16 14                    | 34 35 35 07                                | 00         |
| 06         | 2 31                             | 16 15                    | 34 46 35 24                                | 24         |
| 12         | 2 31                             | 16 17                    | 34 57 35 43                                | 18         |
| 18         | 2 32                             | 16 19                    | 35 08 36 03                                | 12         |
| 24         | 2 32                             | 16 20                    | 35 19 36 20                                | 06         |
| 00         | 2 32                             | 16 21                    | 35 29 36 39                                | 00         |
| 06         | 2 33                             | 16 21                    | 35 35 36 48                                | 24         |
| 12         | 2 33                             | 16 22                    | 35 40 36 57                                | 18         |
| 18         | 2 33                             | 16 23                    | 34 44 37 04                                | 12         |
| 24         | 2 33                             | 16 22                    | 35 47 37 09                                | 06         |
| 00         | 2 33                             | 19 23                    | 35 50 37 12                                | 00         |



A TABLE of the Horizontal Parallaxes and Semidiameters of the Moon.

| Mean Anom. | The Horizontal Parallax of the Moon |    |                |    | The Horizontal Semidiameter of the Moon |    |                |    | Mean Anom. |
|------------|-------------------------------------|----|----------------|----|-----------------------------------------|----|----------------|----|------------|
|            | Excentricities                      |    | Excentricities |    | Excentricities                          |    | Excentricities |    |            |
|            | 43319                               |    | 61946          |    | 43319                                   |    | 61946          |    |            |
| S. D.      | M.                                  | S. | M.             | S. | M.                                      | S. | M.             | S. | S. D.      |
| 12 00      | 55                                  | 35 | 54             | 23 | 15                                      | 4  | 14             | 45 | 0 00       |
| 24         | 55                                  | 35 | 54             | 23 | 15                                      | 05 | 14             | 45 | 06         |
| 18         | 55                                  | 38 | 54             | 26 | 15                                      | 05 | 14             | 46 | 12         |
| 12         | 55                                  | 43 | 54             | 31 | 15                                      | 06 | 14             | 47 | 18         |
| 06         | 55                                  | 48 | 54             | 38 | 15                                      | 08 | 14             | 49 | 24         |
| 00         | 55                                  | 54 | 54             | 47 | 15                                      | 10 | 14             | 52 | 00         |
| 24         | 56                                  | 01 | 54             | 58 | 15                                      | 12 | 14             | 55 | 06         |
| 18         | 56                                  | 09 | 55             | 11 | 15                                      | 14 | 14             | 58 | 12         |
| 12         | 56                                  | 19 | 55             | 25 | 15                                      | 16 | 15             | 02 | 18         |
| 06         | 56                                  | 30 | 55             | 41 | 15                                      | 19 | 15             | 06 | 24         |
| 00         | 56                                  | 42 | 55             | 58 | 15                                      | 23 | 15             | 11 | 00         |
| 24         | 56                                  | 56 | 56             | 17 | 15                                      | 27 | 15             | 16 | 06         |
| 18         | 57                                  | 10 | 56             | 37 | 15                                      | 30 | 15             | 21 | 12         |
| 12         | 57                                  | 25 | 56             | 59 | 15                                      | 34 | 15             | 27 | 18         |
| 06         | 57                                  | 39 | 57             | 22 | 15                                      | 38 | 15             | 34 | 24         |
| 00         | 57                                  | 54 | 57             | 45 | 15                                      | 42 | 15             | 40 | 00         |
| 24         | 58                                  | 10 | 58             | 10 | 15                                      | 47 | 15             | 46 | 06         |
| 18         | 58                                  | 27 | 58             | 35 | 15                                      | 51 | 15             | 53 | 12         |
| 12         | 58                                  | 43 | 59             | 01 | 15                                      | 55 | 16             | 01 | 18         |
| 06         | 58                                  | 58 | 59             | 25 | 16                                      | 00 | 16             | 07 | 24         |
| 00         | 59                                  | 13 | 59             | 48 | 16                                      | 04 | 16             | 14 | 00         |
| 24         | 59                                  | 28 | 60             | 12 | 16                                      | 08 | 16             | 20 | 06         |
| 18         | 59                                  | 43 | 60             | 35 | 16                                      | 12 | 16             | 26 | 12         |
| 12         | 59                                  | 56 | 60             | 56 | 16                                      | 16 | 16             | 32 | 18         |
| 06         | 60                                  | 07 | 61             | 14 | 16                                      | 19 | 16             | 37 | 24         |
| 00         | 60                                  | 16 | 61             | 30 | 16                                      | 21 | 16             | 41 | 00         |
| 24         | 60                                  | 24 | 61             | 44 | 16                                      | 23 | 16             | 45 | 06         |
| 18         | 60                                  | 30 | 61             | 55 | 16                                      | 25 | 16             | 48 | 12         |
| 12         | 60                                  | 39 | 62             | 09 | 16                                      | 26 | 16             | 50 | 18         |
| 06         | 60                                  | 38 | 62             | 08 | 16                                      | 27 | 16             | 51 | 24         |
| 00         | 60                                  | 39 | 62             | 10 | 16                                      | 27 | 16             | 52 | 00         |

# A TABLE of the Reduction of the Time between the true Conjunctions and Oppositions of the Sun and Moon and the nearest Distance of their Centers.

Subtract from the Time of the true Conjunction or Opposition in the Moons Orbit.

| Argum. of Latitude. |       | The true Horary Motion of the Moon from the Sun. |       |       |       |       |       |       |       |       |         |         |         | Argum. of Latitude. |         |
|---------------------|-------|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------|---------|---------------------|---------|
| Sign 0              | 27 M. | 28                                               | 29    | 30    | 31    | 32    | 33    | 34    | 35    | 36 M. | Sign 12 | Sign 18 | Deg. 39 | Sign 12             | Sign 18 |
| Sign 6              | m. s. | m. s.                                            | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | Sign 12 | Sign 18 | Deg. 39 | Sign 12             | Sign 18 |
| Deg. 0              | 0 00  | 0 00                                             | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00    | 0 00    | 0 00    | 0 00                | 0 00    |
| 1                   | 0 35  | 0 34                                             | 0 33  | 0 31  | 0 30  | 0 29  | 0 28  | 0 27  | 0 26  | 0 26  | 0 51    | 1 17    | 29      | 28                  | 27      |
| 2                   | 1 10  | 1 07                                             | 1 05  | 1 03  | 1 00  | 0 58  | 0 56  | 0 55  | 0 53  | 0 51  | 1 17    | 1 42    | 26      | 25                  | 24      |
| 3                   | 1 45  | 1 41                                             | 1 37  | 1 34  | 1 30  | 1 27  | 1 25  | 1 22  | 1 19  | 1 17  | 1 42    | 2 08    | 25      | 24                  | 23      |
| 4                   | 2 20  | 2 15                                             | 2 10  | 2 05  | 2 00  | 1 56  | 1 53  | 1 49  | 1 45  | 1 42  | 2 08    | 2 33    | 23      | 22                  | 21      |
| 5                   | 2 55  | 2 48                                             | 2 42  | 2 36  | 2 30  | 2 25  | 2 21  | 2 16  | 2 12  | 2 08  | 2 33    | 3 04    | 20      | 19                  | 18      |
| 6                   | 3 29  | 3 21                                             | 3 14  | 3 07  | 3 00  | 2 54  | 2 48  | 2 43  | 2 38  | 2 33  | 3 04    | 3 29    | 19      | 18                  | 17      |
| 7                   | 4 04  | 3 54                                             | 3 46  | 3 38  | 3 30  | 3 23  | 3 16  | 3 10  | 3 04  | 2 58  | 3 29    | 3 54    | 18      | 17                  | 16      |
| 8                   | 4 38  | 4 27                                             | 4 17  | 4 08  | 3 59  | 3 51  | 3 43  | 3 36  | 3 29  | 3 23  | 3 54    | 4 19    | 17      | 16                  | 15      |
| 9                   | 5 11  | 4 59                                             | 4 48  | 4 38  | 4 28  | 4 19  | 4 10  | 4 02  | 3 54  | 3 47  | 4 19    | 4 44    | 16      | 15                  | 14      |
| 10                  | 5 44  | 5 31                                             | 5 19  | 5 07  | 4 56  | 4 46  | 4 37  | 4 28  | 4 19  | 4 11  | 4 44    | 5 09    | 15      | 14                  | 13      |
| 11                  | 6 17  | 6 03                                             | 5 49  | 5 37  | 5 25  | 5 14  | 5 03  | 4 53  | 4 44  | 4 35  | 5 09    | 5 34    | 14      | 13                  | 12      |
| 12                  | 6 50  | 6 34                                             | 6 19  | 6 06  | 5 55  | 5 41  | 5 29  | 5 19  | 5 09  | 4 59  | 5 34    | 6 09    | 13      | 12                  | 11      |

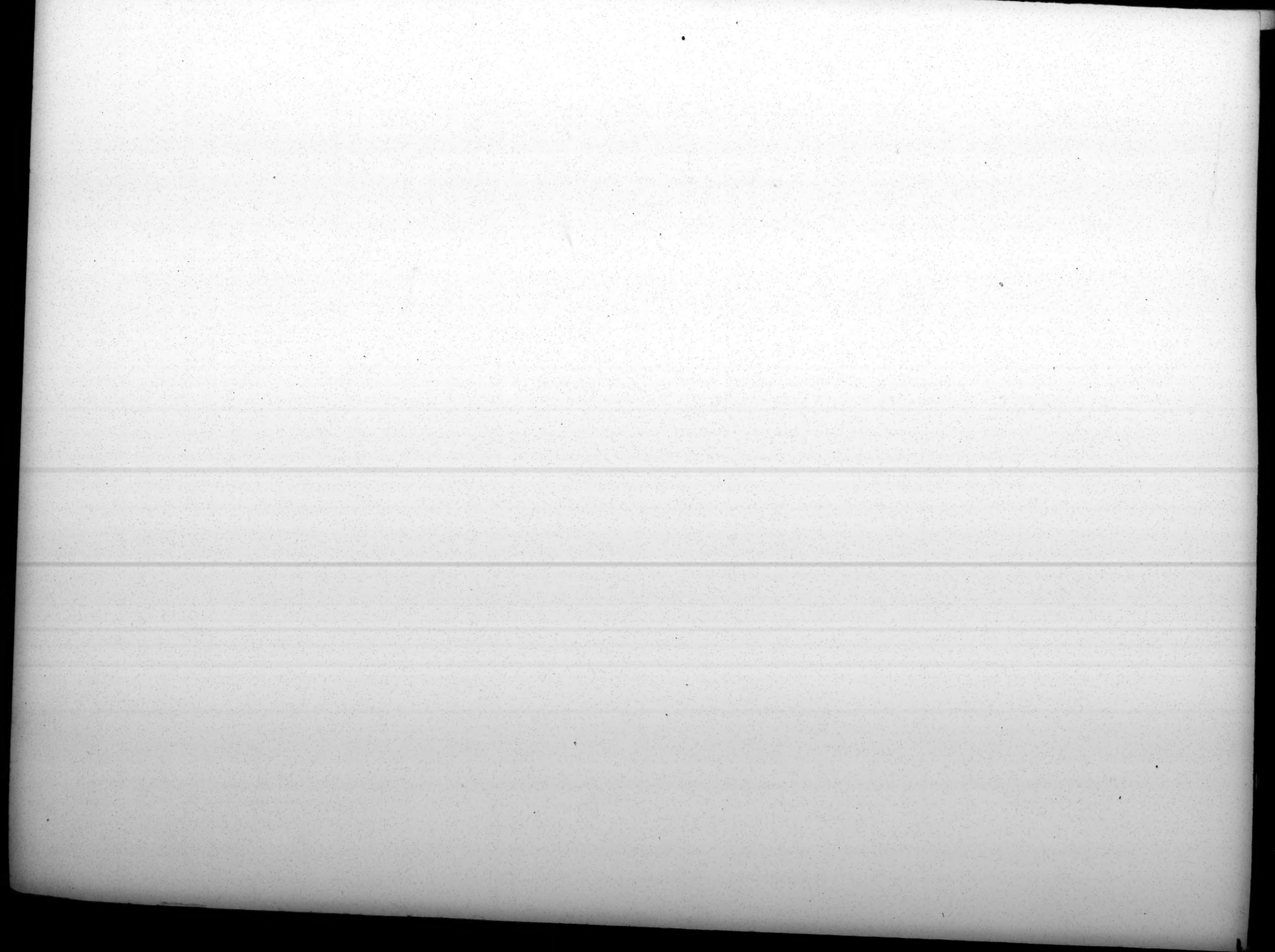
Add to the Time of the true Conjunction and Opposition in the Moon's Orbit.



**A TABLE of the Angle, which the true Motion of the Moon from the Sun makes, with the Ecliptic in Conjunctions and Oppositions.**

The true Horary Motion of the Moon from the Sun.

| Argum. of Latitude. | 27 M. | 28    | 29    | 30    | 31    | 32    | 33    | 34    | 35    | 36    | Argum. of Latitude. |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------------|
| Sign 6              | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | Sign 11             |
| Deg. 0              | 5 46  | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | Deg. 30             |
| 1                   | 5 46  | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 29                  |
| 2                   | 5 46  | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 28                  |
| 3                   | 5 46  | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 27                  |
| 4                   | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 26                  |
| 5                   | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 25                  |
| 6                   | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 24                  |
| 7                   | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 23                  |
| 8                   | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 22                  |
| 9                   | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 21                  |
| 10                  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 20                  |
| 11                  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 5 31  | 19                  |
| 12                  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 5 31  | 5 30  | 18                  |





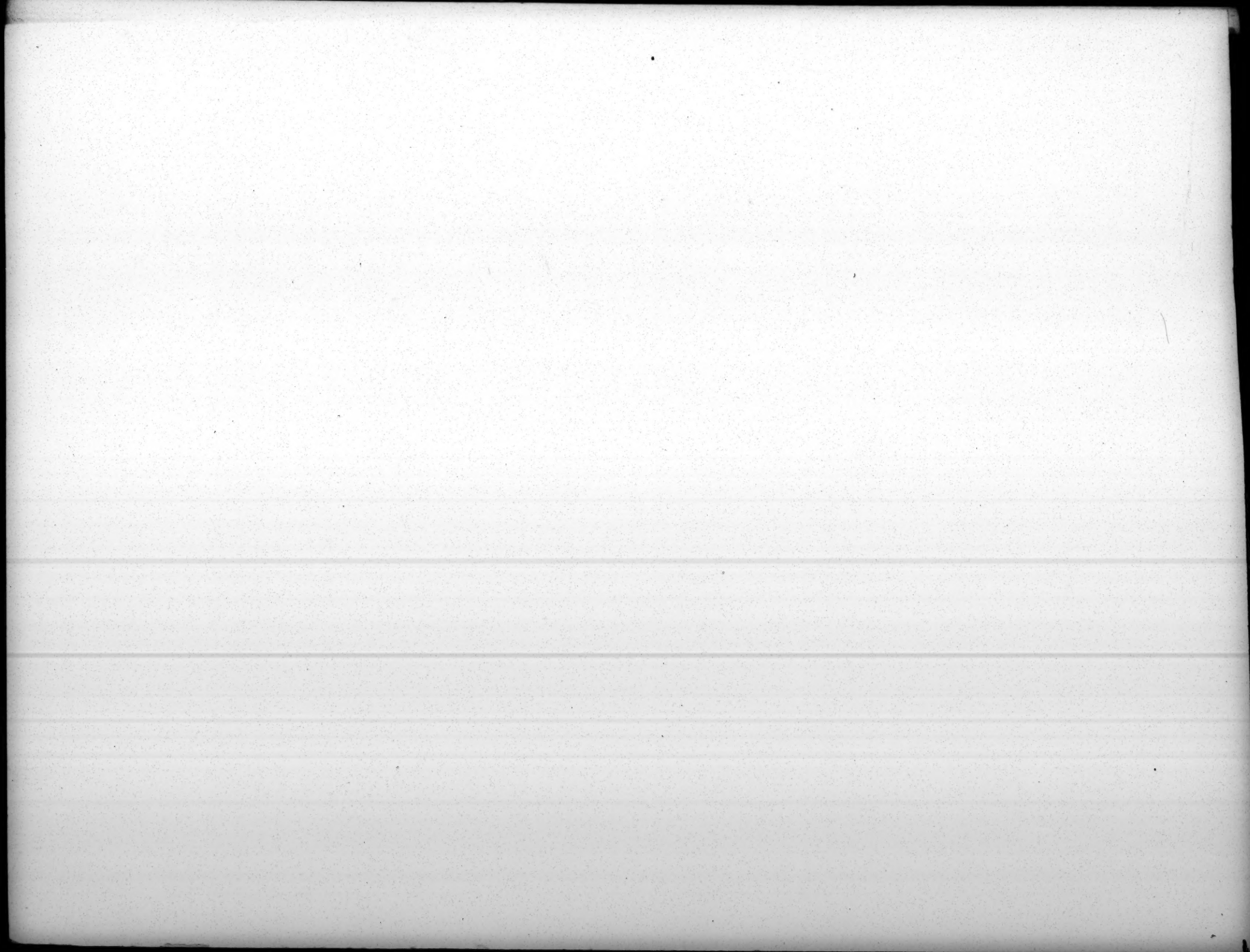
**A TABLE of the Reduction of the Time between the true Conjunctions and Oppositions of the Sun and Moon and the nearest Distance of their Centers.**

Subtract from the Time of the true Conjunction or Opposition in the Moons Orbit.

| Argum. of Latitude. |       | The true <i>Horary Motion</i> of the <i>Moon</i> from the <i>Sun</i> . |       |       |       |       |       |       |       |       |         | Argum. of Latitude. |
|---------------------|-------|------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|---------|---------------------|
| Sign 0              | 27 M. | 28                                                                     | 29    | 30    | 31    | 32    | 33    | 34    | 35    | 36 M. | Sign 5  |                     |
| Sign 6              | m. s. | m. s.                                                                  | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | Sign 11 |                     |
| Deg. 0              | 0 00  | 0 00                                                                   | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | 0 00  | Deg. 30 |                     |
| 1                   | 0 35  | 0 34                                                                   | 0 33  | 0 31  | 0 30  | 0 29  | 0 28  | 0 27  | 0 26  | 0 26  | 29      |                     |
| 2                   | 1 10  | 1 07                                                                   | 1 05  | 1 03  | 1 00  | 0 58  | 0 56  | 0 55  | 0 53  | 0 51  | 28      |                     |
| 3                   | 1 45  | 1 41                                                                   | 1 37  | 1 34  | 1 30  | 1 27  | 1 25  | 1 22  | 1 19  | 1 17  | 27      |                     |
| 4                   | 2 20  | 2 15                                                                   | 2 10  | 2 05  | 2 00  | 1 56  | 1 53  | 1 49  | 1 45  | 1 42  | 26      |                     |
| 5                   | 2 55  | 2 48                                                                   | 2 42  | 2 36  | 2 30  | 2 25  | 2 21  | 2 16  | 2 12  | 2 08  | 25      |                     |
| 6                   | 3 29  | 3 21                                                                   | 3 14  | 3 07  | 3 00  | 2 54  | 2 48  | 2 43  | 2 38  | 2 33  | 24      |                     |
| 7                   | 4 04  | 3 54                                                                   | 3 46  | 3 38  | 3 30  | 3 23  | 3 16  | 3 10  | 3 04  | 2 58  | 23      |                     |
| 8                   | 4 38  | 4 27                                                                   | 4 17  | 4 08  | 3 59  | 3 51  | 3 43  | 3 36  | 3 29  | 3 23  | 22      |                     |
| 9                   | 5 11  | 4 59                                                                   | 4 48  | 4 38  | 4 28  | 4 19  | 4 10  | 4 02  | 3 54  | 3 47  | 21      |                     |
| 10                  | 5 44  | 5 31                                                                   | 5 19  | 5 07  | 4 56  | 4 46  | 4 37  | 4 28  | 4 19  | 4 21  | 20      |                     |
| 11                  | 6 17  | 6 03                                                                   | 5 49  | 5 37  | 5 25  | 5 14  | 5 03  | 4 53  | 4 44  | 4 35  | 19      |                     |
| 12                  | 6 50  | 6 34                                                                   | 6 19  | 6 06  | 5 55  | 5 41  | 5 29  | 5 19  | 5 09  | 4 59  | 18      |                     |

Add to the Time of the true Conjunction and Opposition in the *Moon's Orbit*.

[38]





A TABLE of the *Angle*, which the true Motion of the Moon from the Sun makes, with the *Ecliptic* in Conjunctions and Oppositions.

| Argum. of Latitude. | The true Horary Motion of the Moon from the Sun. |       |       |       |       |       |       |       |       |       | Argum. of Latitude. |
|---------------------|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------------------|
| Sign                | 27 M.                                            | 28    | 29    | 30    | 31    | 32    | 33    | 34    | 35    | 36    | Sign                |
| d. m.               | d. m.                                            | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | d. m. | Sign                |
| Deg. 30             | 5 46                                             | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | Deg. 30             |
| 1                   | 5 46                                             | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 29                  |
| 2                   | 5 46                                             | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 28                  |
| 3                   | 5 46                                             | 5 45  | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 27                  |
| 4                   | 5 45                                             | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 26                  |
| 5                   | 5 45                                             | 5 44  | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 25                  |
| 6                   | 5 44                                             | 5 43  | 5 42  | 5 41  | 5 41  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 24                  |
| 7                   | 5 44                                             | 5 43  | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 23                  |
| 8                   | 5 43                                             | 5 42  | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 22                  |
| 9                   | 5 42                                             | 5 41  | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 21                  |
| 10                  | 5 41                                             | 5 40  | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 20                  |
| 11                  | 5 40                                             | 5 39  | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 5 31  | 19                  |
| 12                  | 5 39                                             | 5 38  | 5 37  | 5 36  | 5 35  | 5 34  | 5 33  | 5 32  | 5 31  | 5 30  | 18                  |

[36]

A TABLE of the mean Motions of the Moon from the Sun.

| Cur. Years<br>of Christ. | The mean Motion of the<br>Moon from the Sun. |    |    |    | Complete Ju-<br>lian Years. | The mean Motion of<br>the Moon from the Sun |    |    |    |
|--------------------------|----------------------------------------------|----|----|----|-----------------------------|---------------------------------------------|----|----|----|
|                          | S.                                           | D. | M. | S. |                             | S.                                          | D. | M. | S. |
| 1                        | 06                                           | 24 | 09 | 42 | 1                           | 04                                          | 09 | 37 | 25 |
| 1501                     | 04                                           | 10 | 25 | 59 | 2                           | 08                                          | 19 | 14 | 48 |
| 1581                     | 10                                           | 04 | 05 | 54 | 3                           | 00                                          | 28 | 52 | 11 |
| 1601                     | 02                                           | 17 | 30 | 55 | 4                           | 05                                          | 20 | 41 | 03 |
| 1621                     | 07                                           | 00 | 55 | 56 | 5                           | 10                                          | 00 | 18 | 27 |
| 1641                     | 11                                           | 14 | 20 | 57 | 6                           | 12                                          | 09 | 55 | 50 |
| 1661                     | 03                                           | 27 | 45 | 58 | 7                           | 06                                          | 19 | 33 | 14 |
| 1681                     | 08                                           | 11 | 10 | 59 | 8                           | 11                                          | 11 | 22 | 05 |
| 1701                     | 00                                           | 24 | 36 | 00 | 9                           | 03                                          | 20 | 59 | 30 |
| 1721                     | 05                                           | 08 | 01 | 01 | 10                          | 08                                          | 00 | 36 | 53 |
| 1741                     | 09                                           | 21 | 26 | 02 | 11                          | 00                                          | 10 | 14 | 17 |
| 1761                     | 02                                           | 04 | 51 | 03 | 12                          | 05                                          | 02 | 03 | 07 |
| 1781                     | 06                                           | 18 | 16 | 04 | 13                          | 09                                          | 11 | 40 | 32 |
| 1801                     | 11                                           | 01 | 41 | 04 | 14                          | 01                                          | 21 | 17 | 55 |
|                          |                                              |    |    |    | 15                          | 06                                          | 00 | 55 | 18 |
| Complete Jul.<br>Years.  | Mean Motion of the<br>Moon from the Sun.     |    |    |    | 16                          | 10                                          | 22 | 44 | 10 |
| 20                       | 04                                           | 13 | 25 | 13 | 17                          | 03                                          | 02 | 21 | 35 |
| 40                       | 08                                           | 26 | 50 | 26 | 18                          | 07                                          | 11 | 58 | 58 |
| 60                       | 01                                           | 10 | 15 | 39 | 19                          | 11                                          | 21 | 36 | 21 |
| 80                       | 05                                           | 23 | 40 | 52 | 20                          | 04                                          | 13 | 25 | 13 |
| 100                      | 10                                           | 07 | 06 | 05 | January                     | 00                                          | 00 | 00 | 00 |
| 200                      | 08                                           | 14 | 12 | 10 | February                    | 00                                          | 17 | 54 | 47 |
| 300                      | 06                                           | 21 | 18 | 15 | March                       | 11                                          | 29 | 15 | 14 |
| 400                      | 04                                           | 28 | 24 | 20 | April                       | 00                                          | 17 | 10 | 02 |
| 500                      | 03                                           | 05 | 30 | 25 | May                         | 00                                          | 22 | 53 | 23 |
| 600                      | 01                                           | 12 | 36 | 30 | June                        | 01                                          | 10 | 48 | 11 |
| 700                      | 11                                           | 19 | 42 | 35 | July                        | 01                                          | 16 | 31 | 33 |
| 800                      | 09                                           | 26 | 48 | 40 | August                      | 02                                          | 04 | 26 | 19 |
| 900                      | 08                                           | 03 | 54 | 45 | September                   | 02                                          | 22 | 21 | 07 |
| 1000                     | 06                                           | 11 | 00 | 50 | October                     | 02                                          | 28 | 04 | 28 |
|                          |                                              |    |    |    | November                    | 03                                          | 15 | 59 | 16 |
|                          |                                              |    |    |    | December                    | 03                                          | 21 | 42 | 36 |



**A TABLE of the mean Motions of the Moon from the Sun.**

| Days. | The Mean Motion of<br>the Moon from the<br>Sun. |    |    |    | H.<br>Min.<br>Sec. | Mean Motion. |    |    | H.<br>Min.<br>Sec. | Mean Motion. |    |    |
|-------|-------------------------------------------------|----|----|----|--------------------|--------------|----|----|--------------------|--------------|----|----|
|       |                                                 |    |    |    |                    | d.           | m. | s. |                    | d.           | m. | s. |
|       | S.                                              | d. | m. | s. |                    | m.           | s. |    |                    | m.           | s. |    |
| 1     | 00                                              | 12 | 11 | 27 | 1                  | 00           | 30 | 29 | 31                 | 15           | 44 | 47 |
| 2     | 00                                              | 24 | 22 | 53 | 2                  | 01           | 00 | 57 | 32                 | 16           | 15 | 16 |
| 3     | 01                                              | 06 | 34 | 20 | 3                  | 01           | 31 | 26 | 33                 | 16           | 45 | 44 |
| 4     | 01                                              | 18 | 45 | 47 | 4                  | 02           | 01 | 54 | 34                 | 17           | 16 | 13 |
| 5     | 02                                              | 00 | 57 | 13 | 5                  | 02           | 32 | 23 | 35                 | 17           | 46 | 42 |
| 6     | 02                                              | 13 | 08 | 40 | 6                  | 03           | 02 | 54 | 36                 | 18           | 17 | 10 |
| 7     | 02                                              | 25 | 20 | 07 | 7                  | 03           | 33 | 20 | 37                 | 18           | 47 | 39 |
| 8     | 03                                              | 07 | 31 | 33 | 8                  | 04           | 03 | 49 | 38                 | 19           | 18 | 07 |
| 9     | 03                                              | 19 | 43 | 00 | 9                  | 04           | 34 | 18 | 39                 | 19           | 48 | 36 |
| 10    | 04                                              | 01 | 54 | 27 | 10                 | 05           | 04 | 46 | 40                 | 20           | 19 | 05 |
| 11    | 04                                              | 14 | 05 | 53 | 11                 | 05           | 35 | 15 | 41                 | 20           | 49 | 33 |
| 12    | 04                                              | 26 | 17 | 20 | 12                 | 06           | 05 | 43 | 42                 | 21           | 20 | 02 |
| 13    | 05                                              | 08 | 28 | 47 | 13                 | 06           | 36 | 12 | 43                 | 21           | 50 | 31 |
| 14    | 05                                              | 20 | 40 | 13 | 14                 | 07           | 06 | 41 | 44                 | 22           | 20 | 59 |
| 15    | 06                                              | 02 | 51 | 40 | 15                 | 07           | 37 | 09 | 45                 | 22           | 51 | 28 |
| 16    | 06                                              | 15 | 03 | 07 | 16                 | 08           | 07 | 38 | 46                 | 23           | 21 | 56 |
| 17    | 06                                              | 27 | 14 | 33 | 17                 | 08           | 38 | 06 | 47                 | 23           | 52 | 25 |
| 18    | 07                                              | 09 | 26 | 00 | 18                 | 09           | 08 | 35 | 48                 | 24           | 22 | 54 |
| 19    | 07                                              | 21 | 37 | 27 | 19                 | 09           | 39 | 04 | 49                 | 24           | 53 | 22 |
| 20    | 08                                              | 03 | 48 | 53 | 20                 | 10           | 09 | 32 | 50                 | 25           | 23 | 51 |
| 21    | 08                                              | 16 | 00 | 20 | 21                 | 10           | 40 | 01 | 51                 | 25           | 54 | 19 |
| 22    | 08                                              | 28 | 11 | 47 | 22                 | 11           | 10 | 30 | 52                 | 26           | 24 | 48 |
| 23    | 09                                              | 10 | 23 | 13 | 23                 | 11           | 40 | 58 | 53                 | 26           | 55 | 17 |
| 24    | 09                                              | 22 | 34 | 40 | 24                 | 12           | 11 | 27 | 54                 | 27           | 25 | 45 |
| 25    | 10                                              | 04 | 46 | 07 | 25                 | 12           | 41 | 55 | 55                 | 27           | 56 | 13 |
| 26    | 10                                              | 16 | 57 | 33 | 26                 | 13           | 12 | 24 | 56                 | 28           | 26 | 43 |
| 27    | 10                                              | 29 | 09 | 00 | 27                 | 13           | 42 | 53 | 57                 | 28           | 54 | 11 |
| 28    | 11                                              | 11 | 20 | 27 | 28                 | 14           | 13 | 21 | 58                 | 29           | 27 | 40 |
| 29    | 11                                              | 23 | 31 | 53 | 29                 | 14           | 43 | 50 | 59                 | 29           | 58 | 08 |
| 30    | 00                                              | 05 | 43 | 20 | 30                 | 15           | 14 | 19 | 60                 | 30           | 28 | 37 |
| 31    | 00                                              | 17 | 54 | 47 |                    |              |    |    |                    |              |    |    |
| 32    | 01                                              | 00 | 06 | 13 |                    |              |    |    |                    |              |    |    |

In Leap Years after February add a Day to the Time  
given, and it's Motion to the rest.

In Leap Years after February add a Day to the Time given, and it's Motion to the rest.

**H**AVING finished the Tables, that concern the Motions of the Sun and Moon, I shall now proceed to explain and enlarge upon a sufficient Number of Observations made by some of the most celebrated Astronomers of this and the last Age, vizt. Tycho Brahe, Longomontanus, Gassendus, Hevelius, Ricciolus, Ballialdus, Cassini, Dr. Halley, Mr. Flamsteed, &c. As they are most of them recorded by that eminent Astronomer Mr. Street, in the Second Edition of his ASTRONOMIA CAROLINA, revis'd by the learned and accurate Dr. Halley, Pages 99 and 100. I might have added as many more; but these being such, as cannot be excepted against, and likewise sufficient to demonstrate the Truth of the Tables in all the Parts thereof, I thought it proper not to make the Book bigger than is necessary.

It may be observed, that the true Equation of Time being not known in Mr. Street's Days, his Equated Time at London of the Middle of these Eclipses is here corrected from the truer Tables of Mr. Flamsteed, to which are added 23 Seconds, to reduce it to the Meridian of Greenwich, which cannot be more or less than a Second or two from Truth.

It remains to answer and anticipate some Objections that may perhaps be raised against my Table of the Moon's Excentricities. I say therefore; first, That if by this Table the Moon's Place may be more nearly and truly found, than by any yet extant, even as near or nearer than is required by Act of Parliament, then one would think the answering any other would be needless; but the Supposition is true, as will appear by comparing my Accounts with those arising from the Table in Mr. Whiston's ASTRONOMICAL LECTURES, and also those of Sir Isaac Newton, as falsely printed in Dr. Gregory's ASTRONOMY. There not being Room for it here, I shall answer other Objections afterwards.





## OBSERVATION. I.

*A. D.* 1573, *Dec.* 8. 7. 13. 21. apparent Time at *Greenwich*. Sun's mean Motion 8. 27. 09. 04. Sun's Apogee 3. 05. 31. 05. Sun's mean Anomaly 5. 21. 37. 59. Equation of the Orbit — 17. 13. Equation of Time — 2. 16. Proportional Parts — 0. 06. Sun's true Place 8. 26. 51. 45 + 2 = 51. 47. Mean Time 7. 11. 05 + 46. for the Time of Opposition in the Moon's Orbit = 7. 11. 51.

| Moon's Eq. | Moon's mean Motion.                                                                                                                                                                     | Moon's Apogee.                                                                                                                    | Moon's ascending Node.                                                                                                                        |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
|            | $\begin{array}{r} s. \quad d. \quad m. \quad s. \quad s. \\ 2. \quad 22. \quad 45. \quad 59. \quad + \quad 28. \\ 2. \quad 22. \quad 46. \quad 27. \\ + \quad 1. \quad 45. \end{array}$ | $\begin{array}{r} 6. \quad 27. \quad 52. \quad 51. \\ - \quad 2. \quad 58. \end{array}$                                           | $\begin{array}{r} 2. \quad 25. \quad 02. \quad 17. \\ + \quad 1. \quad 24 \end{array}$                                                        |
| 1 Eq.      | $\begin{array}{r} 2. \quad 22. \quad 48. \quad 12. \\ - \quad 3. \quad 27. \end{array}$                                                                                                 | $\begin{array}{r} 6. \quad 27. \quad 49. \quad 53. \\ + \quad 11. \quad 45. \quad 02. \end{array}$                                | $\begin{array}{r} 2. \quad 25. \quad 03. \quad 41. \\ + \quad 5. \quad 30. \end{array}$                                                       |
| 2 Eq.      | $\begin{array}{r} 2. \quad 22 \quad 44. \quad 45. \\ + \quad 3. \end{array}$                                                                                                            | $\begin{array}{r} 7. \quad 09. \quad 34. \quad 55. \\ \text{Excent. } 50221. \end{array}$                                         | $\begin{array}{r} 2. \quad 25. \quad 09. \quad 11. \\ \text{Inc. Limit. } 17.59. \end{array}$                                                 |
| 3 Eq.      | $\begin{array}{r} 2 \quad 22. \quad 44. \quad 48. \\ + \quad 4. \quad 05. \quad 06. \end{array}$                                                                                        | $\begin{array}{r} \text{Moon's mean Ano.} \\ 7. \quad 13. \quad 09 \quad 52. \end{array}$                                         |                                                                                                                                               |
| 4, 5 Eq.   | $\begin{array}{r} 2. \quad 26. \quad 49. \quad 54. \\ + \quad 1. \quad 48. \end{array}$                                                                                                 | WHISTON.                                                                                                                          | GREGORY.                                                                                                                                      |
| 6, 7 Eq.   | $\begin{array}{r} 2. \quad 26. \quad 51. \quad 42. \\ \text{Sun's Place.} \\ 8. \quad 26. \quad 51. \quad 47. \end{array}$                                                              | $\begin{array}{r} \text{Excent. } 49789 \\ \text{Moon's Place,} \\ 2. \quad 26. \quad 53. \quad 09. \end{array}$                  | $\begin{array}{r} \text{Excent. } 50600 \\ \text{Moon's Place,} \\ 2. \quad 26. \quad 53. \quad 36. \end{array}$                              |
|            | $\begin{array}{r} s. \\ \text{Diff. } - \quad 5 \\ \text{or } 2 \frac{1}{2} \text{ Miles.} \\ \text{too little.} \end{array}$                                                           | $\begin{array}{r} m. \quad s. \\ \text{Diff. } + \quad 1 \quad 22 \\ \text{or } 41 \text{ Miles} \\ \text{too much.} \end{array}$ | $\begin{array}{r} m. \quad s. \\ \text{Diff. } + \quad 1 \quad 49 \\ \text{or } 54 \frac{1}{2} \text{ Miles} \\ \text{too much.} \end{array}$ |

## OBSERVATION, II.

d. h. m. s. s. m. s.

A. D. 1578, Sept. 15. 12. 26. 51 + 23 = 27. 14. apparent Time at  
 Greenwich. Sun's mean Motion, 6. 04. 21. 47. Sun's Apogee, 3 05  
 36. 05. Sun's mean Anomaly, 2. 28. 45. 41. Equation of the Orbit,  
 - 1. 56. 13. Equation of Time, - 8. 29. Proportional Parts - 21.  
 Sun's true Place, 6. 02. 25. 13 + 12 = 25. 25. Mean Time, 12. 18. 45.  
 + 4. 56. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                     | Moon's Apogee.                                            | Moon's ascending Node.                            |
|------------|---------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------|
|            | 11. 28. 51. 45 + 2. 31.<br>11. 28. 54. 16.<br>+ 11. 47. | I. 11. 58. 40.<br>- 19. 59.                               | 11. 22. 46. 44.<br>+ 9. 30.                       |
| 1 Eq.      | 11. 29. 06. 03.<br>+ 3. 39.                             | I. 11. 38. 41.<br>- 11. 16. 39.                           | 11. 22. 56. 14.<br>+ 28. 24.                      |
| 2 Eq.      | 11. 29. 09. 42.<br>+ 15.                                | I. 00. 22. 02.<br>Excent. 58332.                          | 11. 23. 24. 38.<br>Inc. Limit. 17. 31.            |
| 3 Eq.      | 11. 29. 09. 57.<br>+ 3. 17. 50.                         | Moon's mean Ano.<br>10. 28. 48. 11.                       |                                                   |
| 4, 5 Eq.   | 0. 02. 27. 47.<br>- 1. 58.                              | WHISTON.                                                  | GREGORY.                                          |
| 6, 7 Eq.   | 0. 02. 25. 49.<br>Sun's Place.<br>6. 02. 25. 25.        | Excent. 57431.<br>Moon's Place.<br>0. 02. 24. 52.         | Excent. 58537.<br>Moon's Place.<br>0. 02. 26. 13. |
|            | Diff. + 0. 24.<br>or 12 Miles<br>too much.              | Diff. - 0 33.<br>or 16 $\frac{1}{2}$ Miles<br>too little. | Diff. + 0. 48.<br>or 24 Miles<br>too much.        |



## OBSERVATION, III.

*d. h. m. s.*  
*A. D. 1581. Jan. 19. 09. 06. 36 + 23. viz. 6. 59. apparent Time at Greenwich. Sun's mean Motion, 10. 08. 55. 32. Sun's Apogee, 3. 05. 38. 33. Mean Anomaly, 7. 03. 16. 59. Equation of the Orbit, + 1. 04. 45. Equation of Time, + 14. 07. Proportional Parts, + 36. Sun's true Place, 10. 10. 00. 53 + 4. viz. 57. Mean Time, 9. 21 06. + 1. 29. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq. | Moon's mean Motion.                                               | Moon's Apogee.                                                   | Moon's ascending Node.                                          |
|------------|-------------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------|
|            | 4. 09. 24. 28 + 44.<br>4. 09. 25. 12.<br>- 6. 34.                 | 4. 17. 26. 26.<br>+ 11. 08.                                      | 10. 07. 24. 10.<br>- 5. 17.                                     |
| 1 Eq.      | 4. 09. 18. 38.<br>+ 1. 01.                                        | 4. 17. 37. 34.<br>- 2. 38. 52.                                   | 10. 07. 18. 53.<br>+ 8. 13.                                     |
| 2 Eq.      | 4. 09. 19. 39.<br>+ 4.                                            | 4. 14. 58. 42.<br><i>Excent. 61746.</i>                          | 10. 07. 27. 06.<br><i>Inc. Limit. 17. 59.</i>                   |
| 3 Eq.      | 4. 09. 19. 43.<br>+ 39. 22.                                       | <i>Moon's mean Ano</i><br>11. 24. 21. 09.                        |                                                                 |
| 4, 5 Eq.   | 4. 09. 59. 05.<br>+ 1. 22.                                        | WHISTON.                                                         | GREGORY.                                                        |
| 6, 7 Eq.   | 4. 10. 00. 27.<br><i>Sun's Place</i><br>10. 10. 00. 57.           | <i>Excent. 66464.</i><br><i>Moon's Place.</i><br>4. 10. 00. 47.  | <i>Excent. 66461.</i><br><i>Moon's Place.</i><br>4. 10. 03. 13. |
|            | <i>Diff. - 0. 30.</i><br><i>or 15 miles</i><br><i>too little.</i> | <i>Diff. - 0. 10.</i><br><i>or 5 miles</i><br><i>too little.</i> | <i>Diff. + 2. 16.</i><br><i>or 68 miles</i><br><i>too much.</i> |

## O B S E R V A T I O N. IV.

D. H. M. S.

A. D. 1587, Sept. 6. 08. 26. 00. + 23. viz. 26. 23. apparent Time at Greenwich. Sun's mean Motion 5. 25. 08. 56. Sun's Apogee 3. 05. 45. 31. Sun's mean Anomaly 2, 19. 23. 25. Equation of the Orbit, -1. 53. 45. Equation of Time, -5. 17. Propor. Parts -13. Sun's true Place, 5. 23. 14. 58. - 8. viz. 14. 50. H. M. S. M. S. Mean Time, 8. 21. 06. - 3. 10. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                     | Moon's Apogee.                                           | Moon's ascending Node.                                  |
|------------|---------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|
|            | II. 18. 54. 43 - I. 18.<br>II. 18. 53. 05.<br>+ II. 32. | I. 17. 09. 19.<br>- 19. 33.                              | 5. 29. 12. 02.<br>+ 9. 18.                              |
| 1 Eq.      | II. 19. 04. 37.<br>+ 3. 32.                             | I. 16. 49. 46.<br>- 12. 12. 10.                          | 5. 29. 21. 20.<br>- 18. 29.                             |
| 2 Eq.      | II. 19. 08. 10.<br>- 10.                                | I. 04. 37. 36.<br>Excent. 52477.                         | 5. 29. 02. 51.<br>Inc. Limit. 17. 48.                   |
| 3 Eq.      | II. 19. 08. 00.<br>+ 4. 08. 04.                         | Moon's mean Ano.<br>10. 14. 30. 19.                      |                                                         |
| 4, 5 Eq.   | II. 23. 16. 04.<br>- I. 03.                             | WHISTON.                                                 | GREGORY.                                                |
| 6, 7 Eq.   | II. 23. 15. 01.<br>Sun's Place,<br>5. 23. 14 50.        | Excent. 51683.<br>Moon's Place.<br>II. 23. 12. 29.       | Excent. 52789<br>Moon's Place,<br>II. 23. 16. 13.       |
|            | Diff. + 0. 11.<br>or $5\frac{1}{2}$ Miles<br>too much.  | Diff. -2. 21.<br>or $70\frac{1}{2}$ Miles<br>too little. | Diff. + 1. 23.<br>or $41\frac{1}{2}$ Miles<br>too much. |



## OBSERVATION, V.

*A. D. 1588, March*  $\begin{matrix} d. & h. & m. & s. \\ 2. & 14. & 12. & 20 \end{matrix}$  + 23. viz. 43. apparent Time at Greenwich. Sun's mean Motion,  $\begin{matrix} 11. & 20. & 49. & 52. \end{matrix}$  Sun's Apogee,  $\begin{matrix} 3. & 05. & 46. & 01. \end{matrix}$  Sun's mean Anomaly,  $\begin{matrix} 8. & 15. & 03. & 51. \end{matrix}$  Equation of the Orbit, +  $\begin{matrix} 1. & 52. & 52. \end{matrix}$  Equation of Time, +  $\begin{matrix} 9. & 49. \end{matrix}$  Propor. Parts +  $\begin{matrix} 24. & 5. \end{matrix}$  Sun's true Place,  $\begin{matrix} 11. & 22. & 43. & 08. \end{matrix}$  + 3. viz. 43. 11. Mean Time,  $\begin{matrix} 14. & 22. & 32. & + & 1. & 23. \end{matrix}$  for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                                                                        | Moon's Apogee.                                                                                            | Moon's ascending Node.                                                                                    |
|------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|            | $\begin{matrix} 5. & 27. & 37. & 50. & + & 49. \\ 5. & 27. & 38. & 39. \\ - & 11. & 27. \end{matrix}$      | $\begin{matrix} 2. & 07. & 00. & 51. \\ + & 19. & 24. \end{matrix}$                                       | $\begin{matrix} 5. & 19. & 45. & 42. \\ - & 9. & 13. \end{matrix}$                                        |
| 1 Eq.      | $\begin{matrix} 5. & 27. & 27. & 12. \\ + & 1. & 56. \end{matrix}$                                         | $\begin{matrix} 2. & 07. & 20. & 15. \\ - & 7. & 33. & 34. \end{matrix}$                                  | $\begin{matrix} 5. & 19. & 36. & 29. \\ + & 9. & 28. \end{matrix}$                                        |
| 2 Eq.      | $\begin{matrix} 5. & 27. & 29. & 08. \\ + & 5. \end{matrix}$                                               | $\begin{matrix} 1. & 29. & 46. & 41. \\ \text{Excent. } 45818. \end{matrix}$                              | $\begin{matrix} 5. & 19. & 45. & 57. \\ \text{Inc. Limit. } 17. & 58. \end{matrix}$                       |
| 3 Eq.      | $\begin{matrix} 5. & 27. & 29. & 13. \\ - & 4. & 44. & 52. \end{matrix}$                                   | $\begin{matrix} \text{Moon's mean Ano.} \\ 3. & 27. & 41. & 50. \end{matrix}$                             |                                                                                                           |
| 4, 5 Eq.   | $\begin{matrix} 5. & 22. & 44. & 21. \\ - & 1. & 16. \end{matrix}$                                         | WHISTON.                                                                                                  | GREGORY.                                                                                                  |
| 6, 7 Eq.   | $\begin{matrix} 5. & 22. & 43. & 05. \\ \text{Sun's Place,} \\ 11. & 22. & 43. & 11. \end{matrix}$         | $\begin{matrix} \text{Excent. } 45323. \\ \text{Moon's Place,} \\ 5. & 22. & 46. & 05. \end{matrix}$      | $\begin{matrix} \text{Excent. } 45370. \\ \text{Moon's Place,} \\ 5. & 22. & 46. & 05. \end{matrix}$      |
|            | $\begin{matrix} \text{Diff. } - 0. & 06. \\ \text{or } 3 \text{ Miles} \\ \text{too little.} \end{matrix}$ | $\begin{matrix} \text{Diff. } + 2. & 54. \\ \text{or } 87 \text{ Miles} \\ \text{too much.} \end{matrix}$ | $\begin{matrix} \text{Diff. } + 2. & 54. \\ \text{or } 87 \text{ Miles} \\ \text{too much.} \end{matrix}$ |

# OBSERVATION, VI.

*d. h. m. s.*  
*A. D. 1592. June, 14. 09. 26. 11 + 23. viz. 26. 34. apparent Time at Greenwich. Sun's mean Motion, 3. 03. 10. 22. Sun's Apogee, 3. 05. 50. 31. Sun's mean Anomaly, 11. 27. 19. 51. Equation of the Orbit, + 5. 17. Equation of Time, + 1. 32. Proportional Parts, + 4. Sun's true Place, 3. 03. 15. 43 + 8. viz. 15. 51. Mean Time*  
*h. m. s.*  
*9. 28. 06. + 3. 26. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq. | Moon's mean Motion.                               | Moons's Apogee.                                             | Moon's ascending Node.                            |
|------------|---------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------|
|            | 9. 05. 58. 54 + 1. 43.<br>9. 06. 00. 37.<br>+ 32. | 8. 01. 20. 43.<br>+ 54.                                     | 2. 26. 53. 49.<br>- 26.                           |
| 1 Eq.      | 9. 06. 00. 05.<br>- 3. 12.                        | 8. 01. 21. 37.<br>+ 9. 52. 32.                              | 2. 26. 53. 23.<br>+ 19. 17.                       |
| 2 Eq.      | 9. 05. 56. 53.<br>+ 10.                           | 8. 11. 14. 09.<br>Excent. 59496.                            | 2. 27. 12. 40.<br>Inc. Limit. 17. 46.             |
| 3 Eq.      | 9. 05. 57. 03.<br>- 2. 42. 08.                    | Moon's mean Ano.<br>0. 24. 43. 03.                          |                                                   |
| 4, 5 Eq.   | 9. 03. 14. 55.<br>+ 54.                           | WHISTON.                                                    | GREGORY.                                          |
| 6, 7 Eq.   | 9. 03. 15. 49.<br>Sun's Place,<br>3. 03. 15. 51.  | Excent. 60359.<br>Moon's Place.<br>9. 03. 13. 06.           | Excent. 61113.<br>Moon's Place.<br>9. 03. 11. 43. |
|            | Diff. - 0. 02.<br>or 1 Mile<br>too little.        | Diff. - 2. 45.<br>or 82 $\frac{1}{2}$ Miles.<br>too little. | Diff. - 4. 08.<br>or 124 Miles<br>too little.     |



## OBSERVATION, VII.

*d. h. m. s. m. s.*  
*A. D. 1598, Feb. 10. 17. 16. 39. + 23. viz. 17. 02. apparent Time at*  
*Greenwich. Sun's mean Motion, 11. 00. 49. 36. Sun's Apogee, 3. 05.*  
*56. 28. Sun's mean Anomaly, 7. 24. 53. 08. Equation of the Orbit,*  
*+ 1. 36. 03. Equation of Time, + 14. 17. Proportional Parts, + 36.*  
*Sun's true Place, 11. 02. 26. 15 - 6. viz. 26. 09. Mean Time,*  
**b. m. s. m. s.**  
*17. 31. 19. - 2. 34. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq. | Moon's mean Motion.                                                    | Moon's Apogee.                                                  | Moon's ascending Node                                             |
|------------|------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------|
|            | 5. 06. 00. 46 - 1. 19.<br>5. 05. 59. 27.<br>- 9. 44.                   | 3. 21. 39. 49.<br>+ 16. 30.                                     | 11. 07. 25. 16.<br>- 7. 50.                                       |
| 1 Eq.      | 5. 05. 49. 43.<br>- 3. 46.                                             | 3. 21. 56. 19.<br>+ 11. 27. 55.                                 | 11. 07. 17. 26.<br>- 14. 44.                                      |
| 2 Eq.      | 5. 05. 45. 57.<br>- 8.                                                 | 4. 03. 24. 14.<br><i>Excent. 57653.</i>                         | 11. 07. 02. 42.<br><i>Inc. Limit. 17. 52.</i>                     |
| 3 Eq.      | 5. 05. 45. 49.<br>- 3. 22. 14.                                         | <i>Moon's mean Ano.</i><br>1. 02. 21. 25.                       |                                                                   |
| 4, 5 Eq.   | 5. 02. 23. 35.<br>+ 1. 00.                                             | WHISTON.<br><i>Moon's mean Anom.</i><br>1. 03. 04. 14.          | GREGORY.<br><i>Moon's mean Anom.</i><br>1. 02. 18. 49.            |
| 6, 7 Eq.   | 5. 02. 24. 35.<br><i>Sun's Place.</i><br>11. 02. 26. 09.               | <i>Excent. 56945.</i><br><i>Moon's Place.</i><br>5. 02. 26. 11. | <i>Excent. 58053.</i><br><i>Moon's Place,</i><br>5. 02. 23. 29.   |
|            | <i>Diff. - 1. 34.</i><br><i>or 47 Miles</i><br><i>too little.</i><br>F | <i>Diff. + 0. 02.</i><br><i>or one Mile</i><br><i>too much.</i> | <i>Diff. - 2. 40.</i><br><i>or 80 Miles</i><br><i>too little.</i> |

## OBSERVATION, VIII

*d. h. m. s. m. h. s.*  
*A. D.* 1598, Aug. 6. 6. 46. 44 + 23. *viz.* 47. 07. apparent Time at  
 Greenwich. Sun's mean Motion, 4. 24. 51. 19. Sun's Apogee, 3. 05.  
 56. 59. Sun's mean Anomaly 1. 18. 54. 20. Equation of the Orbit,  
 - 1. 26. 14. Equation of Time, + 3. 40. Proportional Parts, + 9.  
 Sun's true Place, 4. 23. 25. 14. - 5. *viz.* 25. 09. Mean Time,  
*b. m. s.*  
 6. 50. 47. - 1. 56. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                        | Moon's Apogee:                                                   | Moon's ascending Node.                                           |
|------------|------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|
|            | 10. 22. 22 25 - 1. 14.<br>10. 22. 21. 11.<br>+ 8. 45.      | 4. 11. 19. 59.<br>- 14. 50.                                      | 10. 28. 04. 16.<br>+ 7. 02.                                      |
| 1 Eq.      | 10. 22. 29. 56.<br>- 1. 31.                                | 4. 11. 05. 09.<br>+ 4. 14. 46.                                   | 10. 28. 11. 18.<br>- 14. 28.                                     |
| 2 Eq.      | 10. 22. 28. 25.<br>- 8.                                    | 4. 15. 19. 55.<br><i>Excent.</i> 61525.                          | 10. 27. 56. 50.<br><i>Inc. Limit.</i> 17. 53.                    |
| 3 Eq.      | 10. 22. 28. 17.<br>+ 55. 54.                               | <i>Moon's mean Anom.</i><br>6. 07. 08. 32.                       |                                                                  |
| 4, 5 Eq.   | 10. 23. 24. 11.<br>+ 1. 22.                                | WHISTON.<br><i>Moon's mean Anom.</i><br>6. 07. 07 51;            | GREGORY.<br><i>Moon's mean Anom.</i><br>6. 07. 07. 29.           |
| 6, 7 Eq.   | 10. 23. 25. 33.<br><i>Sun's Place.</i><br>+ 4. 23. 25. 09. | <i>Excent.</i> 65835.<br><i>Moon's Place.</i><br>10. 23. 29. 59. | <i>Excent.</i> 65844.<br><i>Moon's Place.</i><br>10. 23. 29. 43. |
|            | <i>Diff.</i> + 0. 24.<br>or 12 Miles<br>too much.          | <i>Diff.</i> + 4. 50.<br>or 145 Miles<br>too much.               | <i>Diff.</i> + 4. 34.<br>or 137 Miles<br>too much.               |



## OBSERVATION IX.

D. H. M. S. H. M. S.

A. D. 1699. Jan. 30. 16. 59. 59. + 23. viz. 17. 00. 22. apparent Time at  
 Greenwich. Sun's mean Motion 10. 19. 44. 04. Sun's Apogee, 3. 05.  
 57. 29. Sun's mean Anomaly 7. 13. 46. 35. Equation of the Orbit  
 + 1. 21. 27. Equation of Time + 14. 59. Proportional Parts + 38.  
 Sun's true Place, 10. 21. 06. 09 + 3. Mean Time 17. 15. 21. + 1. 26.  
 for the Time of Opposition in the Moon's Orbit.

| Moon's<br>Eq. | Moon's mean Motion.                               | Moon's Apogee.                                   | Moon's ascending<br>Node.                         |
|---------------|---------------------------------------------------|--------------------------------------------------|---------------------------------------------------|
|               | 4. 20. 18. 39. + 41.<br>4. 20. 19. 20.<br>-8. 16. | 5. 01. 06. 04.<br>+ 14. 00.                      | 10. 18. 40. 32.<br>- 6. 39.                       |
| 1 Eq.         | 4. 20. 11. 04.<br>+ 1. 20.                        | 5. 01. 20. 04.<br>- 3. 32. 25.                   | 10. 18. 33. 53.<br>+ 7. 44.                       |
| 2 Eq.         | 4. 20. 12. 24.<br>+ 4.                            | 4. 27. 47. 39.<br>Excent. 61629.                 | 10. 18. 41. 37.<br>Inc. Limit. 17. 59.            |
| 3 Eq.         | 4. 20. 12. 28.<br>+ 52. 38.                       | Moon's mean Ano.<br>11. 22. 25 01.               |                                                   |
| 4, 5 Eq.      | 4. 21. 05. 06.<br>+ 1. 42.                        | WHISTON.<br>Moon's mean Ano.<br>11. 22. 26. 30.  | GREGORY.<br>Moon's mean Ano.<br>11. 22. 25. 36.   |
| 6, 7 Eq.      | 4. 21. 06. 48.<br>Sun's Place.<br>10. 21. 06. 12. | Excent. 66154<br>Moon's Place,<br>4. 21. 07. 26. | Excent. 66167.<br>Moon's Place,<br>4. 21. 10. 26. |
|               | Diff. + 0. 40.<br>or 20 Miles,<br>too much.       | Diff. + 1. 14.<br>or 37 Miles<br>too much.       | Diff. + 4 14<br>or 127 Miles<br>too much.         |

## OBSERVATION, X.

*d. h. m. s. m. s.*  
*A. D.* 1609, *July*, 6. 11. 20. 53 + 23 *viz.* 21. 16. *apparent Time at*  
*Greenwich.* Sun's mean Motion, 3. 24. 49. 03. Sun's Apogee, 3. 06.  
 08. 26. Sun's mean Anomaly, 0. 18. 40. 37. Equation of the Orbit,  
 - 36. 24. Equation of Time, + 5. 13. Proportional Parts + 12.  
 Sun's true Place, 3. 24. 12. 51 - 3. *viz.* 12. 48. *Mean Time*, 26. 29.  
 - 1. 20. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                               | Moon's Apogee.                                                  | Ascending Node.                                                  |
|------------|-------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------|
|            | 9. 29. 11. 04. - 44.<br>9. 29. 10. 20.<br>+ 3. 42.                | 7. 05. 32. 23.<br>- 6. 16.                                      | 3. 26. 55. 45.<br>+ 2. 58.                                       |
| 1 Eq.      | 9. 29. 14. 02.<br>- 1. 22.                                        | 7. 05. 26. 07.<br>+ 5. 45. 12.                                  | 3. 26. 58. 43.<br>- 8. 25.                                       |
| 2 Eq.      | 9. 29. 12. 40.<br>- 5.                                            | 7. 11. 11. 19.<br><i>Excent.</i> 45379.                         | 3. 26. 50. 18.<br><i>Inc. Limit.</i> 17. 59.                     |
| 3 Eq.      | 9. 29. 12. 35.<br>- 5. 02. 10.                                    | <i>Moon's mean Ano.</i><br>2. 18. 01. 16.                       |                                                                  |
| 4, 5 Eq.   | 9. 24. 10. 25.<br>+ 1. 46.                                        | WHISTON.<br><i>Moon's mean Ano.</i><br>2. 18. 09. 16.           | GREGORY.<br><i>Moon's mean Ano.</i><br>2. 17. 59. 49.            |
| 6, 7 Eq.   | 9. 24. 12. 11.<br><i>Sun's Place.</i><br>3. 24. 12. 48.           | <i>Excent.</i> 44517.<br><i>Moon's Place.</i><br>9. 24. 17. 21. | <i>Excent.</i> 44434.<br><i>Moon's Place.</i><br>9. 24. 18. 27.  |
|            | <i>Diff.</i> - 0. 37.<br>or 18 $\frac{1}{2}$ Miles<br>too little. | <i>Diff.</i> + 4 33.<br>or 36 $\frac{1}{2}$ Miles<br>too much.  | <i>Diff.</i> + 5. 39.<br>or 169 $\frac{1}{2}$ Miles<br>too much. |



## OBSERVATION, XI

A. D. 1620. June. 4.  $d. 12. 50. 50 \pm 23. viz. 51. 13.$  apparent Time at Greenwich. Sun's mean Motion,  $2. 23. 40. 04.$  Sun's Apogee,  $3. 06. 19. 50.$  Sun's Mean Anomaly,  $11. 17. 20. 14.$  Equation of the Orbit,  $+ 24. 54.$  Equation of Time,  $- 24.$  Proportional Part,  $- 1.$  Sun's true Place,  $2. 24. 04. 57 - 2.$  Mean Time,  $12. 50. 49. - 57.$  for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                                | Moon's Apogee.                                                      | Ascending Node.                                                   |
|------------|--------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
|            | $8. 21. 04. 04 - 26.$<br>$8. 21. 03. 38.$<br>$- 2. 32.$            | $9. 29. 37. 11.$<br>$+ 4. 17.$                                      | $8. 25. 50. 48.$<br>$- 02. 02.$                                   |
| 1 Eq.      | $8. 21. 01. 06.$<br>$+ 3. 23.$                                     | $9. 29. 41. 28.$<br>$- 10. 38. 56.$                                 | $8. 25. 48. 46.$<br>$- 5 17.$                                     |
| 2 Eq.      | $8. 21. 04. 29.$<br>$- 3.$                                         | $9. 19. 02. 32.$<br><i>Excent.</i> 58995.                           | $8. 25. 43. 29.$<br><i>Inc. Limit.</i> 18.00.                     |
| 3 Eq.      | $8. 21. 04. 26.$<br>$+ 3. 00. 46.$                                 | <i>Moon's mean Ano</i><br>$11. 02. 01. 54.$                         |                                                                   |
| 4, 5 Eq.   | $8. 24. 05. 12.$<br>$- 28.$                                        | WHISTON.<br><i>Moon's mean Ano.</i><br>$11. 01. 40. 22.$            | GREGORY.<br><i>Moon's mean Ano.</i><br>$11. 02. 04. 24.$          |
| 6, 7 Eq.   | $8. 24. 04. 44.$<br><i>Sun's Place</i><br>$2. 24. 04. 55.$         | <i>Excent.</i> 59004.<br><i>Moon's Place.</i><br>$8. 24. 04. 08.$   | <i>Excent.</i> 59863.<br><i>Moon's Place.</i><br>$8. 24. 07. 02.$ |
|            | <i>Diff.</i> $- 0. 11.$<br>or $5 \frac{1}{2}$ Miles<br>too little. | <i>Diff.</i> $- 0. 47.$<br>or $23 \frac{1}{2}$ Miles<br>too little. | <i>Diff.</i> $+ 2. 05.$<br>or $62 \frac{1}{2}$ Miles<br>too much. |

# OBSERVATION, XII

D. H. M. S. m. d.

A. D. 1624, Sept. 16. 07. 54. 22 + 23. 01. 54. 46. apparent Time at Greenwich. Sun's mean Motion 6. 06. 00. 09. Sun's Apogee 3. 06. 24. 17. Sun's mean Anomaly 2, 29. 35. 52. Equation of the Orbit, + 1. 56. 18. Equation of Time, - 9. 00. Propor. Parts - 22. Sun's true Place, 6. 04. 03. 29. + 1. Mean Time, <sup>H. M. S.</sup> 7. 45. 46. + 24. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                       | Moon's Apogee.                                             | Ascending Node.                                            |
|------------|-----------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
|            | II. 29. 20. 07 + 14.                                      | 3. 23. 57. 00.                                             | 6. 02. 58. 58.                                             |
|            | II. 29. 20. 21. + 11. 49.                                 | - 20. 00.                                                  | + 9. 30.                                                   |
| 1 Eq.      | II. 29. 32. 10. - 2. 21.                                  | 3. 23. 37. 00. + 9. 05. 55.                                | 6. 03. 08. 28. + 2. 48.                                    |
| 2 Eq.      | II. 29. 29. 49. + 2.                                      | 4. 02. 42. 55. Excent. 46490.                              | 6. 03. 11. 16. Inc. Limit. 18. 00.                         |
| 3 Eq.      | II. 29. 29. 51. + 4. 34. 16.                              | Moon's mean Ano. 7. 26. 46. 56.                            |                                                            |
| 4, 5 Eq.   | 0. 04. 04. 07. + 58.                                      | WHISTON. Moon's mean Ano. 7. 26. 45. 57.                   | GREGORY. Moon's mean Ano. 7. 26. 43. 57.                   |
| 6, 7 Eq.   | 0. 04. 05. 05. Sun's Place, 6. 04. 03. 30. Diff. + 1. 35. | Excent. 46309. Moon's Place. 0. 04. 05. 01. Diff. + 1. 31. | Excent. 46541. Moon's Place, 0. 04. 05. 15. Diff. + 1. 45. |
|            | or 47 $\frac{1}{2}$ Miles too much.                       | or 45 $\frac{1}{2}$ Miles too much.                        | or 52 $\frac{1}{2}$ Miles too much.                        |



## OBSERVATION, XII.

*d. h. m. s. M H Q*  
 A. D. 1625, March 13. 13. 06. 07 + 23. viz. 6. 30. apparent Time at  
 Greenwich. Sun's mean Motion, 0. 01. 39. 42. Sun's Apogee,  
 3. 06. 24. 49. Sun's mean Anomaly, 8. 25. 14. 53. Equation of  
 of the Orbit, + 1. 56. 06. Equation of Time, + 6. 28. Proportional  
 Parts, + 16. Sun's true Place, 0. 03. 36. 04. + 13. Mean  
*b. m. s.*  
 Time, 13. 12. 58. + 5. 15. for the Time of Opposition in the Moon's  
 Orbit.

| Moon's Eq. | Moon's mean Motion.                                     | Moon's Apogee.                                           | Ascending Node.                                         |
|------------|---------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|
|            | 6. 07. 43. 41. + 2. 43.<br>6. 07. 46. 24.<br>— 11. 47.  | 4. 13. 48. 21.<br>+ 19. 58.                              | 5. 23. 32. 42.<br>— 9. 29.                              |
| 1 Eq.      | 6. 07. 34. 37.<br>— 3. 42.                              | 4. 14. 08. 19.<br>+ 12. 13. 43.                          | 5. 23. 23. 13.<br>+ 39. 33.                             |
| 2 Eq.      | 6. 07. 30. 55.<br>+ 16.                                 | 4. 26. 22. 02.<br>Excent. 54313.                         | 5. 23. 53. 46.<br>Inc. Limit. 17. 26.                   |
| 3 Eq.      | 6. 07. 31. 11.<br>— 3. 56. 14.                          | Moon's mean Ano.<br>1. 11. 09. 09.                       |                                                         |
| 4, 5 Eq.   | 6. 03. 34. 57.<br>+ 1. 39.                              | WHISTON.<br>Moon's mean Ano.<br>1. 11. 59. 48.           | GREGORY.<br>Moon's mean Ano.<br>1. 11. 06. 00.          |
| 6, 7 Eq.   | 6. 03. 36. 36.<br>Sun's Place,<br>0. 03. 36. 17.        | Excent. 53300.<br>Moon's Place,<br>0. 03. 39. 14.        | Excent. 54474.<br>Moon's Place,<br>0. 03. 36. 26.       |
|            | Diff. + 0. 19.<br>or 9 $\frac{1}{2}$ Miles<br>too much. | Diff. + 2. 57.<br>or 88 $\frac{1}{2}$ Miles<br>too much. | Diff. + 0. 09.<br>or 4 $\frac{1}{2}$ Miles<br>too much. |

## OBSERVATION, XIV.

*A. D.* 1628. *Jan.* 10. 09. 15. 22 + 23. *viz.* 15. 45. apparent Time at *Greenwich*. Sun's mean Motion, 9. 29. 40. 35. Sun's Apogee, 3. 06. 27. 53. Sun's mean Anomaly, 6. 23. 12. 42. Equation of the Orbit, + 46. 34. Equation of Time, + 11. 56. Proportional Parts, + 30. Sun's true Place, 10. 00. 27. 39 + 2. Mean Time *b. m. s. s.* 9. 27. 41. + 40. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                            | Moons's Apogee.                                                 | Ascending Node.                                                 |
|------------|----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
|            | 3. 26. 52. 59 + 24.<br>3. 26. 53. 23.<br>+ 4. 43.              | 8. 08. 52. 24.<br>+ 8. 00                                       | 3. 28. 51. 02.<br>- 3. 48.                                      |
| 1 Eq.      | 3. 26. 48. 40.<br>- 3. 47.                                     | 8. 09. 00. 24.<br>+ 12. 14. 54.                                 | 3. 28. 47. 14.<br>+ 5. 06.                                      |
| 2 Eq.      | 3. 26. 44. 53.<br>+ 3.                                         | 8. 21. 15. 18.<br><i>Excent.</i> 53453.                         | 3. 28. 52. 20.<br><i>Inc. Limit.</i> 17. 59.                    |
| 3 Eq.      | 3. 26. 44. 56.<br>+ 3. 43. 02.                                 | <i>Moon's mean Ano.</i><br>7. 05. 29. 38.                       |                                                                 |
| 4, 5 Eq.   | 4. 00. 27. 58.<br>+ 34.                                        | <i>WHISTON.</i><br><i>Moon's mean Ano.</i><br>7. 06. 09. 19.    | <i>GREGORY.</i><br><i>Moon's mean Ano.</i><br>7. 05. 26. 26.    |
| 6, 7 Eq.   | 4. 00. 28. 32.<br><i>Sun's Place,</i><br>10. 00. 27. 41.       | <i>Excent.</i> 52590.<br><i>Moon's Place.</i><br>4. 00. 31. 33. | <i>Excent.</i> 53660,<br><i>Moon's Place.</i><br>4. 00. 30. 28. |
|            | <i>Diff.</i> + 0. 51.<br>or $25\frac{1}{2}$ Miles<br>too much. | <i>Diff.</i> + 3. 52.<br>or 116 Miles<br>too much.              | <i>Diff.</i> + 2. 47.<br>or $83\frac{1}{2}$ Miles<br>too much.  |



## OBSERVATION, XV.

*d. h. m. s. m. s.*  
 A. D. 1630, Nov. 9. 10. 43. 13 + 23. viz. 43. 36. apparent Time at  
 Greenwich. Sun's mean Motion, 7. 28. 53. 43. Sun's Apogee, 3. 06.  
 30. 45. Sun's mean Anomaly, 4. 22. 22. 58. Equation of the  
 Orbit, — 1. 11. 57. Equation of Time, — 13. 52. Proportional  
 Parts, — 35. Sun's true Place, 7. 27. 41. 11 — 8. Mean Time,  
*h. m. s. m. s.*  
 10. 29. 44. — 3. 18. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                     | Moon's Apogee.                                    | Moon's ascending Node                                     |
|------------|---------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------|
|            | 2. 01. 50. 36 — 1. 39.<br>2. 01. 48. 57.<br>+ 7. 18.    | 0. 04. 04. 27.<br>— 12. 21.                       | 2. 04. 05. 34.<br>+ 5. 52.                                |
| 1 Eq.      | 2. 01. 56. 15.<br>— 3. 40.                              | 0. 03. 52. 06.<br>+ 12. 11. 38.                   | 2. 04. 11. 26.<br>— 19. 41.                               |
| 2 Eq.      | 2. 01. 52. 35.<br>— 11.                                 | 0. 16. 03. 44.<br>Excent. 52368.                  | 2. 03. 51. 45.<br>Int. Limit. 17. 45.                     |
| 3 Eq.      | 2. 01. 52. 24.<br>— 4. 09. 08.                          | Moon's mean Ano.<br>1. 15. 48. 40.                |                                                           |
| 4, 5 Eq.   | 1. 27. 43. 16.<br>— 2. 08.                              | WHISTON.<br>Moon's mean Anom.<br>1. 16. 07. 39.   | GREGORY.<br>Moon's mean Anom.<br>1. 15. 45. 25.           |
| 6, 7 Eq.   | 1. 27. 41. 08.<br>Sun's Place<br>17. 27. 41. 03.        | Excent. 51798.<br>Moon's Place.<br>1. 27. 48. 31. | Excent. 52694.<br>Moon's Place,<br>1. 27. 40. 02.         |
|            | Diff. + 10. 05.<br>or $2\frac{1}{2}$ Miles<br>too much. | Diff. + 7. 28.<br>or 224 Mile<br>too much.        | Diff. — 1. 01.<br>or $30\frac{1}{2}$ Miles<br>too little. |

# OBSERVATION, XVI.

*d. h. m. s. h. m. s.*  
*A. D. 1631, Oct. 29. 11. 04. 53 + 23. viz. 11. 05. 16. apparent Time at*  
*Greenwich. Sun's mean Motion, 7. 17. 49. 45. Sun's Apogee, 3. 06.*  
*31. 48. Sun's mean Anomaly 4. 11. 17. 57. Equation of the Orbit,*  
*- 1. 28. 21. Equation of Time, - 15. 44. Proportional Parts, - 24.*  
*Sun's true Place, 7. 16. 21. 00. + 1. Mean Time, 10. 49. 32.*  
*+ 29. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq. | Moon's mean Motion.                                               | Moon's Apogee:                                                  | Moon's ascending Node.                                            |
|------------|-------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------|
|            | 1. 16. 28. 07 + 13.<br>1. 16. 28. 20.<br>+ 8. 58.                 | 1. 13. 30. 51.<br>- 15. 11.                                     | 1. 15. 20. 45.<br>+ 7. 12.                                        |
| 1 Eq.      | 1. 16. 37. 18.<br>- 25.                                           | 1. 13. 15. 40.<br>+ 1. 04. 49.                                  | 1. 15. 27. 57.<br>+ 2. 42.                                        |
| 2 Eq.      | 1. 16. 36. 53.<br>+ 1.                                            | 1. 14. 20. 29.<br><i>Excent. 61881.</i>                         | 1. 15. 30. 39.<br><i>Inc. Limit. 18. 00.</i>                      |
| 3 Eq.      | 1. 16. 36. 54.<br>- 15. 54.                                       | <i>Moon's mean Anom.</i><br>0. 02. 16. 25.                      |                                                                   |
| 4, 5 Eq.   | 1. 16. 21. 00.<br>- 1. 43.                                        | <i>WHISTON.</i><br><i>Moon's mean Anom.</i><br>0. 02. 08 33.    | <i>GREGORY.</i><br><i>Moon's mean Anom.</i><br>0. 02. 16. 13.     |
| 6, 7 Eq.   | 1. 16. 19. 17.<br><i>Sun's Place.</i><br>7. 16. 21. 01.           | <i>Excent. 66797.</i><br><i>Moon's Place.</i><br>1. 16. 20. 59. | <i>Excent. 66713.</i><br><i>Moon's Place.</i><br>1. 16. 18. 09.   |
|            | <i>Diff. - 1. 44.</i><br><i>or 52 Miles</i><br><i>too little.</i> | <i>Diff. - 0. 02.</i><br><i>or 1 Mile</i><br><i>too little.</i> | <i>Diff. - 2. 52.</i><br><i>or 86 Miles</i><br><i>too little.</i> |



## OBSERVATION. XVII.

A. D. 1635. Feb. 21. 08. 21. 48 + 23. viz. 22. 11. apparent Time at Greenwich. Sun's mean Motion 11. 11. 20. 10. Sun's Apogee, 3. 06. 35. 16. Sun's mean Anomaly 8. 04. 44. 54. Equation of the Orbit + 1. 45. 57. Equation of Time + 12. 18. Proportional Parts + 31. Sun's true Place, 11. 13. 06. 38 + 3. Mean Time 8. 34. 29. + 1. 10. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                | Moon's Apogee.                                    | Moon's ascending Node.                            |
|------------|----------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
|            | 5. 11. 50. 53. + 31.<br>5. 11. 51. 24.<br>-10. 45. | 5. 28. 25. 09.<br>+ 18. 12.                       | 11. 11. 13. 20.<br>- 8. 39.                       |
| 1 Eq.      | 5. 11. 40. 39.<br>+ 1. 58.                         | 5. 28. 43. 21.<br>- 5. 19. 08.                    | 11. 11. 04. 41.<br>+ 6. 12.                       |
| 2 Eq.      | 5. 11. 42. 37.<br>+ 3.                             | 5. 23. 24. 13.<br>Excent. 61362.                  | 11. 11. 10. 53.<br>Inc. Limit. 17. 59.            |
| 3 Eq.      | 5. 11. 42. 40.<br>+ 1. 20. 40.                     | Moon's mean Ano.<br>11. 18. 18. 27.               |                                                   |
| 4, 5 Eq.   | 5. 13. 03. 20.<br>+ 2. 07.                         | WHISTON.<br>Moon's mean Ano.<br>11. 18. 19. 09.   | GREGORY.<br>Moon's mean Ano.<br>11. 18. 19. 34.   |
| 6, 7 Eq.   | 5. 13. 05. 27.<br>Sun's Place.<br>11. 13. 06. 41.  | Excent. 65234.<br>Moon's Place,<br>5. 13. 06. 15. | Excent. 65364.<br>Moon's Place,<br>5. 13. 10. 15. |
|            | Diff. - 1. 14.<br>or 37 Miles<br>too little.       | Diff. - 0. 26.<br>or 13 Miles<br>too little.      | Diff. + 3. 34.<br>or 107 Miles<br>too much.       |

## OBSERVATION, XVIII.

*A. D.* 1636, *Feb.* 10. 10. 14. 23 + 23 *viz.* 14. 46. apparent Time at *Greenwich.* Sun's mean Motion, 11. 00. 19. 56. Sun's Apogee, 3. 06. 36. 22. Sun's mean Anomaly, 7. 23. 43. 34. Equation of the Orbit, + 1. 34. 41. Eq. of Time, + 14. 18. Propor. Parts + 36. Sun's true Place, 11. 01. 55. 13 + 12. *viz.* 55. 25. Mean Time, 10. 29. 04 + 4. 46. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion                                       | Moon's Apogee.                                                  | Ascending Node.                                                 |
|------------|----------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
|            | 4. 27. 20. 25. + 2. 21.<br>4. 27. 22. 46.<br>- 9. 36.    | 7. 07. 52. 00.<br>+ 16. 16.                                     | 10. 22. 28. 19.<br>- 7. 44.                                     |
| 1 Eq.      | 4. 27. 13. 10.<br>+ 2. 49.                               | 7. 08. 08. 16.<br>- 10. 21. 24.                                 | 10. 22. 20. 35.<br>+ 28. 40.                                    |
| 2 Eq.      | 4. 27. 15. 59.<br>+ 15.                                  | 6. 27. 46. 52.<br><i>Excent.</i> 47755.                         | 10. 22. 49. 15.<br><i>Inc. Limit.</i> 17. 31.                   |
| 3 Eq.      | 4. 27. 16. 14.<br>+ 4. 39. 06.                           | <i>Moon's mean Ano.</i><br>9. 29. 29. 22.                       |                                                                 |
| 4, 5 Eq.   | 5. 01. 55. 20.<br>+ 2. 01.                               | WHISTON.<br><i>Moon's mean Ano.</i><br>9. 29. 20. 43.           | GREGORY.<br><i>Moon's mean Ano.</i><br>9. 29. 32. 28.           |
| 6, 7 Eq.   | 5. 01. 57. 21.<br><i>Sun's Place.</i><br>11. 01. 55. 25. | <i>Excent.</i> 47660.<br><i>Moon's Place.</i><br>5. 01. 52. 17. | <i>Excent.</i> 47923.<br><i>Moon's Place.</i><br>5. 01. 58. 09. |
|            | <i>Diff.</i> + 1. 56.<br>or 58 Miles<br>too much.        | <i>Diff.</i> - 3. 08.<br>or 94 Miles<br>too little.             | <i>Diff.</i> + 2. 44.<br>or 82 Miles<br>too much.               |



## OBSERVATION, XIX.

*d. h. m. s.*  
*A. D. 1638. Dec. 10. 14. 00. 18 + 23. viz. 41. apparent Time at Greenwich. Sun's mean Motion, 8. 29. 38. 45. Sun's Apogee, 3. 06. 39. 18. Sun's Mean Anomaly, 5. 22. 59. 27. Equation of the Orbit, - 14. 27. Equation of Time, - 1. 10. Proportional Parts, - 3. Sun's true Place, 8. 29. 24. 15 + 2. Mean Time, 13. 59. 31. + 44. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq. | Moon's mean Motion.                                                                                                  | Moon's Apogee.                                                                                                                   | Ascending Node.                                                                                                                 |
|------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|            | 3. 03. 39. 31 + 24.<br>3. 03. 39. 55.<br>+ 1. 28.                                                                    | 11. 03. 04. 44.<br>- 2. 29.                                                                                                      | 8. 27. 42. 29.<br>+ 1. 11.                                                                                                      |
| 1 Eq.      | 3. 03. 41. 23.<br>+ 3. 07.                                                                                           | 11. 03. 02. 15.<br>- 10. 57. 52.                                                                                                 | 8. 27. 43. 40.<br>+ 5 07.                                                                                                       |
| 2 Eq.      | 3. 03. 44. 30.<br>+ 3.                                                                                               | 10. 22. 04. 23.<br><i>Excent. 48707.</i>                                                                                         | 8. 27. 48. 47.<br><i>Inc. Limit. 17. 59.</i>                                                                                    |
| 3 Eq.      | 3. 03. 44. 33.<br>- 4. 18. 24.                                                                                       | <i>Moon's mean Ano</i><br>4. 11. 40. 10.                                                                                         |                                                                                                                                 |
| 4, 5 Eq.   | 2. 29. 26. 09.<br>- 1. 33.                                                                                           | WHISTON.<br><i>Moon's mean Ano.</i><br>4. 11. 06. 43.                                                                            | GREGORY.<br><i>Moon's mean Ano.</i><br>4. 11. 43. 21.                                                                           |
| 6, 7 Eq.   | 2. 29. 24. 36.<br><i>Sun's Place</i><br>8. 29. 24. 17.<br><br>Diff. + 0. 19.<br>or $9\frac{1}{2}$ Miles<br>too much. | <i>Excent. 48190.</i><br><i>Moon's Place.</i><br>2. 29. 23. 38.<br><br>Diff. - 0. 39.<br>or $19\frac{1}{2}$ Miles<br>too little. | <i>Excent. 48843.</i><br><i>Moon's Place.</i><br>2. 29. 24. 02.<br><br>Diff. - 0. 15.<br>or $7\frac{1}{2}$ Miles<br>too little. |

## OBSERVATION, XX.

D. H. M. S.

A. D. 1641, October 8. 7. 10. 03 + 23. viz. 10. 26. apparent Time at  
 Greenwich. Sun's mean Motion 6. 27. 32. 19. Sun's Apogee 3. 06. 42. 14.  
 Sun's mean Anomaly 3. 20. 50. 05. Equation of the Orbit, -1. 49. 29.  
 Equation of Time, -14. 44. Propor. Parts - 37. Sun's true Place, 6.  
 25. 42. 13. - 10. Mean Time, 6. 55. 42. - 6. 06 for the Time of  
 Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                                                             | Moon's Apogee.                                                                                    | Ascending Node.                                                                                 |
|------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|            | 0. 20. 59. 50 - 2. 01.<br>0. 20. 57. 49.<br>+ 11. 06.                                           | 2. 28. 07. 50.<br>- 18. 49.                                                                       | 7. 03. 01. 16.<br>+ 8. 56.                                                                      |
| 1 Eq.      | 0. 21. 08. 55.<br>+ 3. 07.                                                                      | 2. 27. 49. 01.<br>- 11. 15. 59.                                                                   | 7. 03. 10. 12.<br>- 22. 32.                                                                     |
| 2 Eq.      | 0. 21. 12. 02.<br>- 12.                                                                         | 2. 16. 33. 02.<br>Excent. 49232.                                                                  | 7. 02. 47. 40.<br>Inc. Limit. 17. 41.                                                           |
| 3 Eq.      | 0. 21. 11. 50.<br>+ 4. 30. 46.                                                                  | Moon's mean Ano.<br>10. 04. 38. 48.                                                               |                                                                                                 |
| 4, 5 Eq.   | 0. 25. 42. 36.<br>- 45.                                                                         | WHISTON.<br>Moon's mean Ano.<br>10. 03. 45. 35.                                                   | GREGORY.<br>Moon's mean Ano.<br>10. 04. 42. 07.                                                 |
| 6, 7 Eq.   | 0. 25. 41. 51.<br>Sun's Place,<br>6. 25. 42. 03.<br>Diff. - 0. 12.<br>or 6 Miles<br>too little. | Excent. 48598.<br>Moon's Place.<br>0. 25. 38. 55.<br>Diff. - 3. 08.<br>or 94 Miles<br>too little. | Excent. 49401.<br>Moon's Place,<br>0. 25. 42. 31.<br>Diff. + 0. 28.<br>or 14 Miles<br>too much. |



## OBSERVATION, XXI.

*d. h. m.*  
 A. D. 1642, April, 4. 13. 51. 58 + 23. viz. 52. 21. apparent Time at  
 Greenwich. Sun's mean Motion, 0. 23. 15. 32. Sun's Apogee,  
 3. 06. 42. 45. Sun's mean Anomaly, 9. 16. 32. 47. Equation of  
 the Orbit, + 1. 50. 39. Equation of Time, - 06. Proportional  
 Parts, 00. Sun's true Place, 0. 25. 06. 11. + 2. Mean  
*h. m. s.*  
 Time, 13. 52. 15. + 44. for the Time of Opposition in the Moon's  
 Orbit.

| Moon's Eq. | Moon's mean Motion.                                 | Moon's Apogee.                                    | Ascending Node.                                   |
|------------|-----------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
|            | 7. 00. 12. 26. + 23.<br>7. 00. 12. 49.<br>- 11. 13. | 3. 17. 59. 37.<br>+ 19. 01.                       | 6. 23. 34. 50.<br>- 9. 02.                        |
| 1 Eq.      | 7. 00. 01. 36.<br>+ 52.                             | 3. 18. 18. 38.<br>- 3. 35. 34.                    | 6. 23. 25. 48.<br>+ 5. 06.                        |
| 2 Eq.      | 7. 00. 02. 28.<br>+ 3.                              | 3. 14. 43. 04.<br>Excent. 44232.                  | 6. 23. 30. 54.<br>Inc. Limit. 17. 59.             |
| 3 Eq.      | 7. 00. 02. 31.<br>- 4. 56. 36.                      | Moon's mean Ano.<br>3. 15. 19. 27.                |                                                   |
| 4, 5 Eq.   | 6. 25. 05. 55.<br>+ 18.                             | WHISTON.<br>Moon's mean Ano.<br>3. 15. 37. 06.    | GREGORY.<br>Moon's mean Ano.<br>3. 15. 20. 37.    |
| 6, 7 Eq.   | 6. 25. 06. 13.<br>Sun's Place,<br>0. 25. 06. 13.    | Excent. 43977.<br>Moon's Place,<br>6. 25. 07. 24. | Excent. 43741.<br>Moon's Place,<br>6. 25. 09. 35. |
|            | Diff. + 0. 00.<br>exactly true                      | Diff. + 1 11.<br>or 35 Miles<br>too much.         | Diff. + 3. 22.<br>or 101 Miles<br>too much.       |

## OBSERVATION, XXII.

*d. h. m.*  
*A. D.* 1642. *Sept.* 27. 15. 53. 53 + 23. *viz.* 54. 16. apparent Time  
 at *Greenwich*. Sun's mean Motion, 6. 16. 48. 59. Sun's Apogee,  
 3. 06. 43. 15. Sun's mean Anomaly, 3. 10. 05. 44. Equation of the  
 Orbit, — 1. 54. 51. Equation of Time, — 12. 19. Proportional Parts,  
 — 31. Sun's true Place, 6. 14. 53. 37 + 0. Mean Time  
*b. m. s. s.*  
 15. 41. 57. + 13. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion.                                             | Moons's Apogee.                                                 | Ascending Node.                                                 |
|------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
|            | 0. 10. 15. 23. + 07.<br>0. 10. 15. 30.<br>+ 11. 39.             | 4. 07. 36. 37.<br>— 19. 44.                                     | 6. 14. 15. 23.<br>+ 9. 23.                                      |
| 1 Eq.      | 0. 10. 27. 09.<br>— 2. 39.                                      | 4. 07. 16. 53.<br>+ 9. 58. 40.                                  | 6. 14. 24. 46.<br>+ 1. 28.                                      |
| 2 Eq.      | 0. 10. 24. 30.<br>+ 00.                                         | 4. 17. 15. 33.<br><i>Excent.</i> 47270.                         | 6. 14. 26. 14.<br><i>Inc. Limit.</i> 18. 00.                    |
| 3 Eq.      | 0. 10. 24. 30.<br>+ 4. 27. 32.                                  | <i>Moon's mean Ano.</i><br>7. 23. 08. 57.                       |                                                                 |
| 4, 5 Eq.   | 0. 14. 52. 02.<br>+ 1. 24.                                      | WHISTON.<br><i>Moon's mean Ano.</i><br>7. 23. 11. 43.           | GREGORY.<br><i>Moon's mehn Ano.</i><br>7. 23. 06. 00.           |
| 6, 7 Eq.   | 0. 14. 53. 26.<br><i>Sun's Place,</i><br>6. 14. 53. 37.         | <i>Excent.</i> 47086.<br><i>Moon's Place.</i><br>0. 14. 53. 28. | <i>Excent.</i> 47449.<br><i>Moon's Place.</i><br>0. 14. 54. 18. |
|            | <i>Diff.</i> — 0. 11.<br>or $5\frac{1}{2}$ Miles<br>too little. | <i>Diff.</i> — 0. 09.<br>or $4\frac{1}{2}$ Miles<br>too little. | <i>Diff.</i> + 0. 41.<br>or $20\frac{1}{2}$ Miles<br>too much.  |



## OBSERVATION, XXIII.

*d. h. m. s. m. s.*  
*A. D. 1654, Aug. 17. 10. 42. 45 + 23. viz. 43. 08. apparent Time at*  
*Greenwich. Sun's mean Motion, 5. 06. 16. 56. Sun's Apogee, 3. 06.*  
*55. 44. Sun's mean Anomaly, 1. 29. 21. 12. Equation of the*  
*Orbit, - 1. 38. 46. Equation of Time, + 00. 57. Proportional*  
*Parts, + 2. Sun's true Place, 5. 04. 38. 12 + 12. Mean Time,*  
*h. m. s. m. s.*  
*10. 44. 05. + 4. 49. for the Time of Opposition in the Moon's Orbit.*

| Moon's Eq.                          | Moon's mean Motion.                                             | Moon's Apogee.                                                   | Moon's ascending Node                                            |
|-------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------|
|                                     | 11. 09. 26. 22 + 2. 40.<br>11. 09. 29. 02.<br>+ 10. 00.         | 8. 11. 19. 19.<br>- 16. 58.                                      | 10. 24. 20. 10.<br>+ 8. 04.                                      |
| 1 <sup>st</sup> Eq.                 | 11. 09. 39. 02.<br>- 1. 01.                                     | 8. 11. 02. 21.<br>+ 3. 23. 28.                                   | 10. 24. 28. 14.<br>+ 30. 24.                                     |
| 2 <sup>nd</sup> Eq.                 | 11. 09. 38. 01.<br>+ 16.                                        | 8. 14. 25. 49.<br><i>Excent. 44122.</i>                          | 10. 24. 58. 38.<br><i>Inc. Limit. 17. 27.</i>                    |
| 3 <sup>rd</sup> Eq.                 | 11. 09. 38. 17.<br>- 5. 01. 00.                                 | <i>Moon's mean Ano.</i><br>2. 25. 12. 28.                        |                                                                  |
| 4 <sup>th</sup> 5 <sup>th</sup> Eq. | 11. 04. 37. 17.<br>+ 50.                                        | WHISTON.<br><i>Moon's mean Anom.</i><br>2. 24. 57. 10.           | GREGORY.<br><i>Moon's mean Anom.</i><br>2. 25. 11. 22.           |
| 6 <sup>th</sup> 7 <sup>th</sup> Eq. | 11. 04. 38. 07.<br><i>Sun's Place.</i><br>5. 04. 38. 24.        | <i>Excent. 43936.</i><br><i>Moon's Place.</i><br>11. 04. 39. 16. | <i>Excent. 43710.</i><br><i>Moon's Place,</i><br>11. 04. 40. 55. |
|                                     | <i>Diff. - 0. 17.</i><br>or $8\frac{1}{2}$ Miles<br>too little. | <i>Diff. + 0. 52.</i><br>or 26 Miles<br>too much.                | <i>Diff. + 2. 31.</i><br>or $75\frac{1}{2}$ Miles<br>too much.   |

## OBSERVATION, XXIV.

By Dr. HALLEY and Mr. FLAMSTEED.

*d. h. m. s.*  
*A. D.* 1678, *Oct.* 19. 08. 22. 20. apparent Time at *Greenwich.*  
 Sun's mean Motion, 7. 08. 27. 45. Sun's Apogee, 3. 07. 21. 11.  
 Sun's mean Anomaly, 4. 01. 06. 34. Equation of the Orbit,  
 — 1. 40. 26. Equation of Time, — 16. 02. Proportional Parts, — 40.  
*b. m. s. s.*  
 Sun's true Place, 7. 06. 46. 39. Mean Time, 8. 06. 18. — 5.  
 for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's Mean Motion.                                           | Moon's Apogee.                                                  | Ascending Node.                                                 |
|------------|---------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
|            | 1. 02. 23. 22 — 03.<br>1. 02. 23. 19.<br>+ 10. 12.            | 5. 04. 56. 01.<br>— 17. 16.                                     | 7. 06. 47. 59.<br>+ 8. 12.                                      |
| 1 Eq.      | 1. 02. 33. 31.<br>— 3. 08.                                    | 5. 04. 38. 45.<br>+ 11. 15. 46.                                 | 7. 06. 56. 11.<br>— 0. 29.                                      |
| 2 Eq.      | 1. 02. 30. 23.<br>+ 0. 00.                                    | 5. 15. 54. 31.<br><i>Excent.</i> 49227.                         | 7. 06. 55. 42.<br><i>Inc. Limit.</i> 18. 00.                    |
| 3 Eq.      | 1. 02. 30. 23.<br>+ 4. 14. 24.                                | <i>Moon's mean Anom.</i><br>7. 16. 35. 52.                      |                                                                 |
| 4, 5 Eq.   | 1. 06. 44. 47.<br>+ 2. 01.                                    | <i>WHISTON.</i><br><i>Moon's mean Anom.</i><br>7. 16. 46 05;    | <i>GREGORY.</i><br><i>Moon's mean Anom.</i><br>7. 16. 32. 31.   |
| 6, 7 Eq.   | 1. 06. 46. 48.<br><i>Sun's Place.</i><br>7. 06. 46. 39.       | <i>Excent.</i> 48794.<br><i>Moon's Place.</i><br>1. 06. 46. 01. | <i>Excent.</i> 49395.<br><i>Moon's Place.</i><br>1. 06. 47. 28. |
|            | <i>Diff.</i> + 0. 09:<br>or $4\frac{1}{2}$ Miles<br>too much. | <i>Diff.</i> — 0. 38.<br>or 19 Miles<br>too little.             | <i>Diff.</i> + 0. 49.<br>or $86\frac{1}{2}$ Miles<br>too much.  |



## OBSERVATION. XXV.

By Mr. FLAMSTEED, and CASSINI.

D. H. M. S.

A. D. 1681, Aug. 18. 15. 27. 25. apparent Time at Greenwich.  
 Sun's mean Motion, 5. 07. 54. 48. Sun's Apogee, 3. 07. 24. 10.  
 Sun's mean Anomaly, 2. 00. 30. 38. Equation of the Orbit,  
 — 1. 39. 59. Equation of Time + 31. Proportional Part, + 1.  
H. M. S. M. S.  
 Sun's true Place, 5. 06. 14. 50 — 4. Mean Time 15. 27. 56. — 2. 58.  
 for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's Mean Motion.                                      | Moon's Apogee.                                  | Ascending Node.                                 |
|------------|----------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
|            | 11. 10. 49. 27. — 1. 37.<br>11. 10. 47. 50.<br>+ 10. 08. | 9. 00. 09. 50.<br>— 17. 11.                     | 5. 12. 01. 45.<br>+ 8. 10.                      |
| 1 Eq.      | 11. 10. 57. 58.<br>— 2. 42.                              | 8. 29. 52. 39.<br>+ 10. 19. 00.                 | 5. 12. 09. 55.<br>— 17. 56.                     |
| 2 Eq.      | 11. 10. 55. 16.<br>— 10.                                 | 9. 10. 11. 39.<br>Excent. 47699.                | 5. 11. 51. 59.<br>Inc. Limit. 17. 48.           |
| 3 Eq.      | 11. 10. 55. 06.<br>— 4. 39. 24.                          | Moon's mean Ano.<br>2. 00. 43. 27.              |                                                 |
| 4, 5 Eq.   | 11. 06. 15. 42.<br>— 06.                                 | WHISTON.<br>Moon's mean Ano.<br>2. 00. 50. 39.  | GREGORY.<br>Moon's mean Ano.<br>2. 00. 40. 25.  |
| 6, 7 Eq.   | 11. 06. 15. 36.<br>Sun's Place, 11. 06. 14. 46.          | Excent. 47613.<br>Moon's Place, 11. 05. 18. 33. | Excent. 47870.<br>Moon's Place, 11. 06. 14. 48. |
|            | Diff. + 0. 50.<br>or 25 Miles.<br>too much.              | Diff. + 3. 47.<br>or 113 Miles.<br>too much.    | Diff. + 0. 02.<br>or 1 Mile.<br>too much.       |

## OBSERVATION, XXVI.

*A. D.* 1729, *July* 28. <sup>d.</sup> 13. <sup>h.</sup> 02. <sup>m.</sup> 47 + <sup>s.</sup> 23 *viz.* <sup>m.</sup> 3. <sup>s.</sup> 10. *apparent Time at Greenwich.* Sun's mean Motion, 4. 17. 28. 38. Sun's Apogee, 3. 08. 14. 30. Sun's mean Anomaly, 1. 09. 14. 08. Equation of the Orbit, - 1. 12. 10. Eq. of Time, + 5. 07. *Propor. Parts* + 12. Sun's true <sup>m.</sup> <sup>s.</sup> Place, 4. 16. 16. 40 + 1. Mean Time, 13. 08. 17 + 35. for the Time of Opposition in the Moon's Orbit.

| Moon's Eq. | Moon's mean Motion    | Moon's Apogee.          | Ascending Node.            |
|------------|-----------------------|-------------------------|----------------------------|
|            | 10. 11. 24. 18. + 20. | 2. 01. 01. 25.          | 10. 14. 44. 13.            |
|            | 10. 11. 24. 38.       | - 12. 24.               | + 5. 54.                   |
|            | + 7. 19.              |                         |                            |
| 1 Eq.      | 10. 11. 31. 57.       | 2. 00. 49. 01.          | 10. 14. 50. 07.            |
|            | - 1. 47.              | + 7. 12. 51.            | + 4. 23.                   |
| 2 Eq.      | 10. 11. 30. 10.       | 2. 08. 01. 52.          | 10. 14. 54. 30.            |
|            | + 2.                  | <i>Excent.</i> 45719.   | <i>Inc. Limit.</i> 18. 00. |
| 3 Eq.      | 10. 11. 30. 12.       | <i>Moon's mean Ano.</i> |                            |
|            | + 4. 46. 56.          | 8. 03. 28. 20.          |                            |
| 4, 5 Eq.   | 10. 16. 17. 08.       | WHISTON.                | GREGORY.                   |
|            | - 1. 05.              | <i>Moon's mean Ano.</i> | <i>Moon's mean Ano.</i>    |
|            |                       | 8. 03. 31. 58.          | 8. 03. 26. 08.             |
| 6, 7 Eq.   | 10. 16. 16. 03.       | <i>Excent.</i> 45126.   | <i>Excent.</i> 45161.      |
|            | <i>Sun's Place.</i>   | <i>Moon's Place.</i>    | <i>Moon's Place.</i>       |
|            | 4. 16. 16. 41.        | 10. 16. 15. 05.         | 10. 16. 12. 25.            |
|            | <i>Diff.</i> - 0. 38. | <i>Diff.</i> - 1 36.    | <i>Diff.</i> - 4 16.       |
|            | or 19 Miles           | or 48 Miles             | or 128 Miles               |
|            | too little.           | too little.             | too little.                |



## OBSERVATION, XXVII.

A. D. 1690, April 7. <sup>D. H. M.</sup> 7. 49. 20 + 19. <sup>S.</sup> viz. 39. apparent Time at Greenwich. Sun's mean Motion, 0. 26. 19. 48. Apogee, 3. 07. 33. 13. Mean Anomaly, 9. 18. 46. 35. Eq. Orbit, + 1. 49. 10. Eq. Time, - 0. 51. Proportional Parts, - 2. Sun's true Place, 0. 28. 08. 56. Mean Time, <sup>H. M. S.</sup> 7. 48. 48.

| Moon's Eq. | Moon's Mean Motion.                                                                      | Moon's Apogee.                                                                                              | Ascending Node.                                                                                                                          |
|------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|            | 4. 14. 58. 25.<br>- 11. 04.                                                              | 8. 21. 30. 36.<br>+ 18. 46.                                                                                 | 11. 25. 01. 32.<br>- 8. 55.                                                                                                              |
| 1 Eq.      | 4. 14. 47. 21.<br>+ 3. 21.                                                               | 8. 21. 49. 22.<br>- 12. 12. 04.                                                                             | 11. 24. 52. 37.<br>+ 1. 21. 22.                                                                                                          |
| 2 Eq.      | 4. 14. 50. 52.<br>+ 43.                                                                  | 8. 09. 37. 18.<br><i>Excent. 52435.</i>                                                                     | 11. 026. 13. 59.<br><i>Inc. Limit. 12. 35.</i>                                                                                           |
| 3 Eq.      | 4. 14. 51. 35.<br>+ 5. 34. 28.                                                           | <i>Moon's Mean Ano.</i><br>8. 05. 14. 17.                                                                   | <i>Vert. Dist. M's. higher</i><br><i>Limb, 3. 02. 50.</i>                                                                                |
| 4 Eq.      | 4. 20. 26. 03.<br>- 24. 38.                                                              | <i>April, 7 at Noon,</i><br>S's. Pla. 0. 27. 49. 51.<br>R. Asc. 25. 50. 11.                                 | <i>Error Div. + 4.</i><br><i>Error Wall. - 1. 30.</i>                                                                                    |
| 5 Eq.      | 4. 20. 01. 25.<br>+ 1. 43.                                                               | Sun's Place at Night,<br>0 28. 08. 56.<br>R. Asc. 26. 08. 19.                                               | <i>Refract. + 33.</i><br><i>Sem. Moon + 16. 04.</i><br><i>Vert. Dist. M's. Cent.</i><br>34. 18. 01.                                      |
| 6 Eq.      | 4. 20. 03. 08.<br>- 52.                                                                  | Dif. R. Asc. 18. 98.<br>R. Asc. M's. Center,<br>143. 33. 04.                                                | <i>Paral. Alt. - 32. 57.</i><br><i>True Vert. Dist. M's.</i><br><i>Center, 33. 45. 04.</i><br><i>True Alt. M's. Cent.</i><br>56. 14. 56. |
| 7 Eq.      | 4. 20. 02. 16.<br>Reduct. + 6. 27.                                                       | Hor. Par. Syz. 59 12.<br>Prop. Hor. Par. 58. 28.<br>M's. ap. Diam. 32. 08.                                  | <i>Dec. N. M's. Cent.</i><br>17. 43. 26.                                                                                                 |
| Long. Cal. | 4. 20. 08. 43.                                                                           | Parallax Alt. 32. 57.                                                                                       | <i>Greg. M's. mean An.</i><br>8. 05. 17. 35.                                                                                             |
| Long. Obs. | 4. 20. 06. 58.                                                                           | <i>Wh. M's. mean Ano.</i><br>8. 05. 01. 34.<br><i>Excent. 51895.</i><br>Moon's Longitude,<br>4. 19. 58. 21. | <i>Excent. 52752.</i><br>Moon's Longitude,<br>4. 20. 11. 09.                                                                             |
|            | <i>Diff. + 1. 45.</i><br><i>or 52 <math>\frac{1}{2}</math> Miles</i><br><i>too much.</i> | <i>Diff. - 8. 37.</i><br><i>or 258 <math>\frac{1}{2}</math> Miles</i><br><i>too little.</i>                 | <i>Diff. + 4. 11.</i><br><i>or 125 <math>\frac{1}{2}</math> Miles</i><br><i>too much.</i>                                                |

## OBSERVATION, XXVIII.

D. H. M. S.

A. D. 1690, *June*, 11. 12. 11. 33 + 17. viz. 50. apparent Time at  
*Greenwich*. Sun's mean Motion 3. 00. 34. 34. Apogee, 3. 07. 33. 25.  
 Mean Anom. 11. 23. 01. 09. Eq. Orbit, + 13. 48. Eq. Time, + 1.  
 13. Proportional Parts + 3. Sun's true Place, 3. 00. 48. 25.  
H. M. S.  
 Mean Time, 12. 13. 03.

| Moon's Eq. | Moon's Mean Motion.                                    | Moon's Apogee.                                                                                 | Ascending Node.                                                                                |
|------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|            | 9. 03. 51. 27.<br>— 1. 24.                             | 8 28. 46. 20.<br>+ 2. 22.                                                                      | 11. 21. 34. 26.<br>— 1. 08.                                                                    |
| 1 Eq.      | 9. 03. 50. 03.<br>— 15.                                | 8. 28. 48. 42.<br>+ 41. 54.                                                                    | 11. 21. 33. 18.<br>— 29. 15.                                                                   |
| 2 Eq.      | 9. 03. 49. 48.<br>— 15.                                | 8. 29 30. 36.<br><i>Excent.</i> 61906.                                                         | 11. 21. 04. 03.<br><i>Inc. Limit.</i> 0. 28.                                                   |
| 3 Eq.      | 9. 03. 49. 33.<br>— 30. 10.                            | <i>Moon's Mean Ano.</i><br>0. 04. 18. 57.                                                      | Vert. Dist. M's. lower<br>Limb, 80. 51. 00.                                                    |
| 4 Eq.      | 9. 03. 19. 23.<br>+ 2. 55.                             | <i>June</i> , 11 Noon,<br>S's. Pla. 3. 00. 19. 21.<br>R. A. 90. 21. 06.                        | Error Div. 0. 06.<br>Error Wall. — 1. 30.                                                      |
| 5 Eq.      | 9. 03. 22. 18.<br>+ 12.                                | Sun's Place at Night,<br>3. 00. 48. 25.<br>R. A. 90. 52. 56.                                   | Sem. Moon — 14. 45.<br>Refract. + 4. 48.                                                       |
| 6 Eq.      | 9. 03. 22. 30.<br>+ 6.                                 | Diff. R. A. 31. 20.<br>R. A. M's. Center.<br>273. 49. 56.                                      | Vert. Dist. M's. Cent.<br>80. 39. 33.                                                          |
| 7 Eq.      | 9. 03. 22. 36.<br>Reduct. + 1. 39.                     | Hor. Par. Syz. 54. 24.<br>Prop. Hor. Par. 54. 23.                                              | Par. Alt. — 53. 40.<br>True Vert. Dist. M's.<br>Center 79. 45. 53.                             |
| Long. Cal. | 9. 03. 24. 15.                                         | Diam. ap. M's. 29. 30.                                                                         | True Alt. M's. Cent.<br>10. 14. 07.                                                            |
| Long. Obs. | 9. 03. 23. 10.                                         | Parallax Alt. 53. 40.                                                                          | Dec. S. M's. Center,<br>28. 17. 23.                                                            |
|            | Diff. + 1. 05.<br>or $3\frac{1}{2}$ Miles<br>too much. | Wh. M's. mean Ano.<br>0. 04. 22. 21.<br>Excent. 668250.<br>Moon's Longitude,<br>9. 03. 23. 16. | Greg. M's. mean An.<br>0. 04. 18. 45.<br>Excent. 66737.<br>Moon's Longitude,<br>9. 03. 22. 03. |
|            |                                                        | Diff. + 0. 06.<br>or 3 Miles,<br>too much.                                                     | Diff. — 1. 07.<br>or $3\frac{1}{2}$ Miles<br>too little.                                       |



## OBSERVATION, XXIX.

A. D. 1691, Dec. 18. <sup>D. H. M. S.</sup> 06. 27. 00 + 32. apparent Time at Greenwich.  
 Sun's mean Motion, 9. 07. 22. 36. Apogee, 3. 07. 35. 01.  
 Mean Anom. 5. 29. 47. 35. Eq. Orbit, - 26. Eq. Time, + 2.  
 36. Proportional Parts, + 7. Sun's true Place, 9. 07. 22. 17.  
<sup>H. M. S.</sup>  
 Mean Time, 6. 30. 08.

| Moon's Eq. | Moon's mean Motion.                          | Moon's Apogee.                                                                                | Ascending Node.                                                                               |
|------------|----------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
|            | 0. 23. 37. 03.<br>+ 3.                       | 11. 00. 34. 36.<br>- 4.                                                                       | 10. 22. 11. 46.<br>+ 2.                                                                       |
| 1 Eq.      | 0. 23. 37. 11.<br>+ 3. 46.                   | 11. 00. 34. 32.<br>- 12. 13. 00.                                                              | 10. 22. 11. 48.<br>- 1. 29. 39.                                                               |
| 2 Eq.      | 0. 23. 40. 57.<br>- 47.                      | 10. 18. 21. 32.<br>Excent. 52654.                                                             | 10. 20. 42. 09.<br>Inc. Limit. 9. 03.                                                         |
| 3 Eq.      | 0. 23. 40. 10.<br>- 5. 20. 56.               | Moons Mean Ano.<br>2. 05. 18. 38.                                                             | Vert. Dist. M's lower<br>Limb. 41. 17. 10.                                                    |
| 4 Eq.      | 0. 18. 10. 14.<br>- 13. 57.                  | Dec. 18 at Noon,<br>S's Pla. 9. 07. 05. 42.                                                   | Error Div. + 20.<br>Error Wall. - 2. 30.                                                      |
| 5 Eq.      | 0. 18. 05. 17.<br>+ 1. 21.                   | R. A. 277. 43. 42.<br>Sun's Place at Night,<br>9. 07. 22. 17.                                 | Refract. + 42.<br>Sem. Moon - 15. 20.                                                         |
| 6 Eq.      | 0. 18. 06. 38.<br>- 2. 08.                   | R. A. 278. 02. 39.<br>Diff. R. A. 18. 57.                                                     | Par. Alt. - 36. 36.<br>True Vert. Dist. M's<br>Center, 40. 23. 46.                            |
| 7 Eq.      | 0. 18. 04. 30.<br>Reduct. - 6. 22.           | R. A. Moon's Center,<br>14. 55. 39.                                                           | True Alt. M's Cent.<br>49. 36. 14.                                                            |
| Long. Cal. | 0. 17. 58. 08.                               | Hor. Par. Syz. 56. 34.<br>Prop. Hor. Par. 55. 47.                                             | Dec. N. M's Center,<br>11. 04. 44.                                                            |
| Long. Obs. | 0. 17. 59. 18.                               | Diam. ap. M's. 30. 40.<br>Par. Alt. 36. 36.                                                   |                                                                                               |
|            | Diff. - 1. 10.<br>or 35 Miles<br>too little. | Wh. M's. mean Anc.<br>2. 04. 47. 30.<br>Excent. 51955.<br>Moon's Longitude,<br>0. 18. 01. 19. | Greg. M's mean An.<br>2. 05. 11. 52.<br>Excent. 52944.<br>Moon's Longitude,<br>0. 17. 55. 34. |
|            | Diff. + 0. 00.<br>or 1 Miles<br>too much.    | Diff. + 2. 01.<br>or 60 $\frac{1}{2}$ Miles<br>too much.                                      | Diff. - 3. 44.<br>or 112 miles<br>too little.                                                 |

## OBSERVATION, XXX.

A. D. 1698. <sup>D.</sup> June, 16. <sup>H.</sup> 14. <sup>M.</sup> 46. 33 <sup>S.</sup> + 23. viz. 56. apparent Time at Greenwich. Sun's mean Motion, 3. 05. 40. 16. Apogee, 3. 07. 41. 40. Mean Anomaly, 11. 27. 58. 26. Eq. Orbit, + 4. 00. Eq. Time, + 2. 20. Proportional Parts, + 6. Sun's true Place, 3. 05. 44. 22. <sup>H.</sup> Mean Time, 14. 49. 16. <sup>M.</sup> <sup>S.</sup>

| Moon's Eq. | Moon's Mean Motion.                                            | Moon's Apogee.                                                      | Ascending Node.                                                       |
|------------|----------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|
|            | 10. 22. 35. 45.<br>— 24.                                       | 7. 24. 52. 33.<br>+ 41.                                             | 6. 16. 34. 06.<br>— 20.                                               |
| 1 Eq.      | 10. 22. 35. 21.<br>— 3. 32.                                    | 7. 24. 53. 14.<br>+ 11. 30. 57.                                     | 6. 16. 33. 46.<br>+ 33. 58.                                           |
| 2 Eq.      | 10. 22. 31. 49.<br>+ 17.                                       | 8. 06. 24. 11.<br><i>Excent.</i> 57538.                             | 6. 17. 07. 44.<br><i>Inc. Limit.</i> 0. 38.                           |
| 3 Eq.      | 10. 22. 32. 06.<br>— 6. 18. 28.                                | <i>Moon's Mean Ano.</i><br>2. 16. 07. 55.                           | Vert. Dist. M's higher<br>Limb, 63. 46. 40.                           |
| 4 Eq.      | 10. 16. 13. 38.<br>+ 32. 43.                                   | <i>June</i> 16 at Noon,<br>S's. Pla. 3. 05. 09. 08.                 | Error Div. + 20.                                                      |
| 5 Eq.      | 10. 16. 46. 21.<br>— 22.                                       | R. A. 95. 36. 53.<br>Sun's Place at Night,<br>3. 05. 44. 22.        | Error Wall. — 7. 30.                                                  |
| 6 Eq.      | 10. 16. 45. 59.<br>+ 1. 32.                                    | R. A. 96. 15. 13.<br>Diff. R. A. 38. 20.                            | Retract. + 1. 40.                                                     |
| 7 Eq.      | 10. 16. 47. 31.<br>Reduct. + 5. 39.                            | R. A. M's Center,<br>317. 59. 13.                                   | Sem. Moon + 15. 28.                                                   |
| Long. Cal. | 10. 16. 53. 10.                                                | Hor. Par. Syz. 57. 08.                                              | Vert. Dist. M's. Cent.<br>63. 56. 38.                                 |
| Long. Obs. | 10. 16. 52. 35.                                                | Prop. Hor. Par. 56. 47.                                             | Par Alt. — 51. 01.                                                    |
|            | <i>Diff.</i> + 0. 35.<br>or $17\frac{1}{2}$ Miles<br>too much. | Diam. ap. M's. 30. 56.<br>Par. Alt. 51. 01.                         | True Vert. Dist. M's.<br>Center, 63. 05. 37.                          |
|            |                                                                | <i>Wh.</i> M's mean Ano.<br>2. 16. 36. 07.<br><i>Excent.</i> 56909. | True Alt. M's. Cent.<br>26. 54. 23.                                   |
|            |                                                                | Moon's Longitude,<br>10. 17. 03. 18.                                | Dec. S. M's. Center.<br>11. 37. 07.                                   |
|            |                                                                | <i>Diff.</i> + 10. 43.<br>or $321\frac{1}{2}$ Miles<br>too much.    | <i>Greg.</i> M's. mean An.<br>2. 16. 05. 10.<br><i>Excent.</i> 57917. |
|            |                                                                |                                                                     | Moon's Longitude,<br>10. 16. 50. 46.                                  |
|            |                                                                |                                                                     | <i>Diff.</i> — 1. 49.<br>or $54\frac{1}{2}$ Miles<br>too little.      |



Here I have given the Reader a sufficient Number of Authentick Observations; in the examining of every one whereof, I have been as faithful to a Second of Motion, in the other two Accounts, as in my own. They are here placed all together; that at one View the Difference may be clearly seen.

It may be observed, that by my Account the Error in finding the *Moon's* Place never amounts to 2 *Minntes*, or 60 *Miles*, even upon the *Earth's* Equator, and in some Latitudes not half so much: But in the much greater Part, *viz.* 20 Observations, the Difference never exceeds 20 *Miles*; and in two more does not reach 30; by all which I am entitled to the full *Præmium* granted by the *Act of Parliament*. As to the other Accounts; tho' they come very near in some Cases, even nearer than mine, yet, in others they are intolerably wide; of which 14 in one, and 17 in the other are out of the Compass set by the *Act*: So that nothing of Certainty can be depended upon from them. The Reason whereof will in due Place be given.

It may not be improper here (lest any Objection may be rais'd) to shew, how I have reduced Mr. *Street's* Equated Time at *London* of the Middle of these Eclipses to the true apparent Time there, and by adding 23 *Seconds* to the *Meridian* of *Greenwich*. For tho' his Tables of the Equation of Time be wrong (the true Reason of it being not then ascertain'd) yet since we know how, by his Tables he reduced the true Time to the Mean, it is easy by the same to bring back this mean Time to the apparent true Time; and afterwards by the true Tables of Mr. *Flamsteed* to reduce it truly to the Equated or mean Time.

|     |    | <i>Wb.</i><br>Miles. | Miles. | <i>Gr.</i><br>Miles. |
|-----|----|----------------------|--------|----------------------|
| Ob. | 1  | + 41                 | - 2    | + 54                 |
|     | 2  | + 16                 | + 12   | + 24                 |
|     | 3  | - 5                  | - 15   | + 68                 |
|     | 4  | - 70                 | + 5    | + 41                 |
|     | 5  | + 87                 | - 3    | + 87                 |
|     | 6  | - 82                 | - 1    | - 124                |
|     | 7  | + 1                  | - 47   | - 80                 |
|     | 8  | + 145                | + 12   | + 137                |
|     | 9  | + 37                 | + 20   | + 127                |
|     | 10 | × 136                | - 18   | + 169                |
|     | 11 | - 23                 | - 5    | + 62                 |
|     | 12 | + 45                 | + 47   | + 52                 |
|     | 13 | + 88                 | + 9    | + 4                  |
|     | 14 | + 116                | + 25   | + 83                 |
|     | 15 | + 224                | + 2    | - 30                 |
|     | 16 | - 1                  | - 52   | - 86                 |
|     | 17 | - 13                 | - 37   | + 107                |
|     | 18 | - 94                 | + 58   | + 82                 |
|     | 19 | - 19                 | + 9    | - 7                  |
|     | 20 | - 94                 | - 6    | + 14                 |
|     | 21 | + 35                 | - 60   | + 101                |
|     | 22 | - 4                  | - 5    | + 20                 |
|     | 23 | × 26                 | - 8    | + 75                 |
|     | 24 | - 19                 | + 4    | + 24                 |
|     | 25 | + 113                | + 25   | + 1                  |
|     | 26 | - 48                 | - 19   | - 128                |
|     | 27 | - 258                | + 52   | + 125                |
|     | 28 | + 3                  | + 32   | - 33                 |
|     | 29 | + 60                 | - 35   | - 112                |
|     | 30 | + 321                | + 17   | - 54                 |

I shall shew this in the first Observation (which may suffice for all the rest) as here follows.

|                                    | The Earth's mean Anom.       |     |     |     | Præcession of the Equinox.                          |     |     |
|------------------------------------|------------------------------|-----|-----|-----|-----------------------------------------------------|-----|-----|
| <i>A. D.</i> 1651:                 | 6.                           | 14. | 15. | 34. | D.                                                  | M.  | S.  |
| Year 12.                           | 11.                          | 29. | 55. | 37. | 27.                                                 | 04. | 00. |
| Dec.                               | 10.                          | 29. | 11. | 38. |                                                     | 9.  | 36. |
| Day 8                              |                              | 7.  | 53. | 06. |                                                     |     | 44. |
| Hour 7                             |                              |     | 17. | 15. |                                                     |     | I.  |
| Minutes 13                         |                              |     |     | 32. | Præc. Equinox 27. 14. 21.                           |     |     |
| M. Anom.                           | 5.                           | 21. | 33. | 42. | M. S.<br>Subtract from the mean Time 1. 11.         |     |     |
| Long. Sun<br>from 1 *<br>of Aries. |                              |     |     |     | Add to the mean Time, - - 1. 09.                    |     |     |
|                                    | 7.                           | 29. | 35. | 51. | Equation of Time — - 0. 02.                         |     |     |
|                                    | +                            | 27. | 14. | 21. | H. M. S. S.<br>App. Time at London, 7. 12. 58 + 23. |     |     |
| Long. Sun<br>from the<br>Equinox.  | 8.                           | 26. | 50. | 12. | H. M. S. S.<br>App. Time at Greenwich, 7. 13. 2.    |     |     |
| <i>A. D.</i> 1561.                 | 9.                           | 19. | 40. | 22. | 3. 05. 17. 30.                                      |     |     |
| Years 12                           | 0.                           | 00. | 05. | 26. | 12. 36.                                             |     |     |
| Dec. 8                             | 11.                          | 07. | 05. | 28. | 59.                                                 |     |     |
| Hours 7                            |                              |     | 17. | 15. | 3. 05. 31. 05.                                      |     |     |
| Min. 13                            |                              |     |     | 32. | 8. 27. 09. 04.                                      |     |     |
| Sec. 21.                           |                              |     |     | 1.  | 5. 21. 37. 59. M. Ano.                              |     |     |
| Mean Mot.<br>Sun.                  | 8.                           | 27. | 09. | 04. | Equation of Time, - 2. 16.                          |     |     |
|                                    | Eq. Orbit - 17. 13.          |     |     |     | H. M. S. S.<br>Mean Time, 7. 11. 05. + 46.          |     |     |
|                                    | 8.                           | 26. | 51. | 51. | for the Time of Opposition                          |     |     |
|                                    | Proport. Parts - 6.          |     |     |     | in the Moon's Orbit.                                |     |     |
| Sun's true<br>Place.               | 8. 26. 51. 45. + 2 = 51. 47. |     |     |     | H. M. S. S.<br>7. 11. 51.                           |     |     |

Having



Having proceeded thus far I shall now shew, the Uses of the Table of *Logistical Logarithms*.

1. If 60 *Minutes* be the first Number, add the *Logarithms* of the 2d. and third Numbers together, and the Sum will be the *Logarithm* of the Number required. Thus in the first *Observation* just now explain'd; the *Sun's* mean Motion is, 8: 27. 09. 04. and the mean Anomaly, 5. 21. 37. 59. then in the Table of the Equation, the Number answering to 5 *Deg.* 21 *Minutes* is — 18. 30. and the Number under it is, 16. 28. the Difference is 2. 02. Then the Question will be, If 60 *Minutes* give 2. 02. what will 37. 59. give? In the Table look for 2 *Minutes* at the Top, and overagainst 2 *Seconds* in the Left-Hand Column is the *Logarithm* 14699. Likewise, under 37, and oversagainst 59 is the *Logarithm* 1986. the Sum is 16685. Look for this in the Table, and you will find the nearest to it to be 16698, which answers to 1 *Minute*, 17 *Seconds*; Subtract this from 18. 30. the Remainder will be 17. 13. This according to the Title subtracted from the *Sun's* mean Motion, 8: 27. 09. 04. leaves 8. 26. 51. 51. for the *Sun's* Place first equated. Then to find the Equation of Time; in the first Table, under the *Sun's* mean Anomaly, 5 *Degrees*, 21 *Minutes* is — 1. 13. and under it — 1. 05. the Difference is 8 *Seconds*. Therefore if 60 *Minutes* give 8 *Seconds*, what will 37. 59. give? The *Logarithm* answering to 8 *Seconds* is 26532; and that answering to 37. 59. is as before 1986; the Sum is 28518; the nearest to which in the Table is 28573, answering to 5 *Seconds*. which subtracted from 1. 13. leaves 1. 08. this according to the Title is to be subtracted from the apparent Time, 7 *H.* 13 *M.* 21 *Sec.* In the Second Table of the Equation of Time look for the *Sun's* Place, 8. 26. 51. 51. or Sag. 26. and you will find 1. 27. the next under it is 1. 05. the Difference is 22. Then if 60 *Minutes* give 22 *Seconds*, what will 51. 51. give? The *Logarithm* answering to 22 *Seconds* is 22139. and that to 51. 51. is 634. the Sum 22773. look for in the Table, and the *Logarithm* nearest to it 22775 answers to 19 *Seconds*; this subtracted from 1. 27. leaves — 1. 08. which added

to  $-1.08$ . found by the first Table because they are both of the same Denomination, that is both  $-$  or negative, the Sum is  $-2.16$ . otherwise the Difference must have been taken with the Denomination of the greater : This  $2.16$ . subtracted from the apparent Time  $7\text{ H. }13\text{ M. }21\text{ Secs.}$ , leaves  $7.11.05$ . for the mean Time. Then to find the Proportional Parts ; look in the Table of the true *Horary* Motion of the Earth, for the *Sun's* mean Anomaly, and you will find  $2\text{ Min. }33\text{ Secs.}$ . Then the Question is ; If  $60\text{ Minutes}$  give  $2.33$  ; what will  $2.16$ . give ? The Answer will be  $-0.06$ . or negative, because the Equation  $-2.16$ . was so. Thus you have seen the first Use of the Table.

II. When  $60\text{ Min.}$  is the 2d Number ; from the *Logarithm* of the 3d subtract that of the first, and the Remainder will be the *Logarithm* of the Number required. For Example ; If  $10\text{ Min. }48\text{ Secs.}$  give  $60\text{ Minutes}$ , what will  $3.29$ . give ? From the *Logarithm*  $12362$ , answering to  $3.29$ , subtract  $7447$ , which answers to  $10.48$ . the Remainder look for in the Table, and you will find it under  $19$  at the Top, and over-against  $21$  in the Left-hand Column : So that if  $10\text{ Minutes }48\text{ Secs.}$  give  $60\text{ Minutes}$ , then  $3.29$ . will give  $19.21$ . and so much may suffice for the Second Use.

III. If  $60\text{ Minutes}$  be none of the three Numbers given ; then from the Sum of the *Logarithms* answering to the 2d and 3d Numbers, subtract that, which answers to the first ; the Remainder will be the *Logarithm* of the 4th, or of the Number required ; but when any Number exceeds  $60\text{ Minutes}$ , then take the Half thereof. Thus in finding the *Moon's* first Equation, (see Page 25th of the other Book, viz. of the *Humble Address*.) the Proportion is, as  $1\text{ Deg. }56\text{ Min. }20\text{ Sec.}$  to  $17\text{ Min. }13\text{ Sec.}$  in the first *Observation*, viz. the Equation of the *Earth's* Orbit ; so is  $11.49$ . to  $+1.45$ . and so is  $20\text{ Min.}$  to  $-2.58$ . and so is  $9.30$ . to  $+1.24$ . Here because,  $1.56.20$ . exceeds  $60\text{ Min.}$  therefore I take it's Half  $58\text{ Min. }10\text{ Sec.}$  the *Logarithm* whereof is  $135$ . the Half of  $11.49$ . is  $5.34$  it's *Logarithm*  $10073$ . the Half of  $20\text{ Min.}$  is  $10\text{ Min.}$  it's *Logarithm*  $7782$ . the Half of  $9\text{ Min. }30\text{ Sec.}$  is  $4.45$ . it's *Logarithm*  $11015$ .



\* *N. B.* These *Logarithms* in finding this first Equation of the *Moon* must always thus be used. For Instance here ;

The 2d Number is 17. 13. its *Logarithm* ——— 5422

The 3d Number is 5. 54. — *Log.* ——— 10073

Sum 15495

The 1st Number is 58. 10. — *Log.* ——— 135

Rem. 15360

The 4th Number is +1 45. — *Log.* ——— 15351

This Number according to the Direction given in the afore-cited *Page*, must be + or Affirmative, because the Equation of the Orbit was — or Negative.

Again, for finding the Equation of the *Moon's* Apogee.

The 2d Number is 17. 13. — *Log.* ——— 5422

The 3d Number is 10. 00. — *Log.* ——— 7782

Sum 13204

The 1st Number is 58. 10. — *Log.* ——— 135

Rem. 13069

The 4th Number is — 2. 58. — *Log.* ——— 13059

which must be Negative

Lastly, To find the Equation of *Dragon's* Head,  
or the *Moon's* Ascending Node.

The 2d Number is 17. 13. — *Log.* ——— 5422

The 3d Number is 4. 45. — *Log.* ——— 11015

Sum 16437

The 1st Number is 58. 10. — *Log.* ——— 135

Rem. 16302

The 4th Number is +1. 24. ——— 16320

This again must be + or Affirmative, as in the aforesaid *Page*. And this may suffice for finding these Equations at all Times ; and also for the Uses of the Table of *Logarithms*, which in all Astronomical Observations is very easy, useful, and necessary.

## To find the Moon's Second Equation.

Having first subtracted the Place of the Moon's Apogee, first equated from the true Place of the Sun, say thus; As Radius is to the Sine of the Double Distance of the Sun from the next Syzygia or Quadrature, (by Syzygia is meant either the Conjunction with, or Opposition to that Place of the Apogee,) so is the natural Number answering to the Logarithm in the Table found by the Sun's mean Anomaly, to the Natural Number required. This must be added, if the Sun be moving to the Syzygia; but if from it, must be subtracted. Thus for Example; In the 1st Observation, from the Sun's true Place 8. 26. 51. 47. subtract 6. 27. 49. 53. The Remainder is 1. 29. 01. 54. The Complement whereof to 90 Degrees, is the Sun's nearest Distance to the Quadrature; viz. 1. 00. 58. 06. This doubled makes 2. 01. 56. 12. the Sine of 61. 56. 12. is found thus. Look in the Table of Artificial Sines for 61 Degrees 57 Minutes, you will find 9,945733. and for 61 Degrees, 56 Minutes, you'll find 9. 945666. The Difference is 67. Then the Question is; If 60 minutes give 67, what will 12 give? The nearest Answer is 12. This added to 9. 945666 makes 9. 945678 for the Sine of 61. 56. 12. Next look in the little Table (designed for this Equation) for the Sun's mean Anomaly, and you will find for 5 Sines, 15 Degrees, this Logarithm 2. 369216. and for 6 Signs, the Logarithm 2. 372912, the Difference is 3696. From the Sun's mean Anomaly, 9.945678 5. 21. 37. 59. subtract 5. 15. 00. 00. the Remainder is 2.370850 6. 37. 59. which reduced makes 23879 Seconds. Then if 15 Degrees or 54000 Seconds give 3696, what will 23879 give? The Answer 1634 added to 2, 369216, makes 2,316528 2,370850. Then as Radius is to 9, 945678, so is 2,370850 to 2,316528. The Natural Number answering to which, is 207 Seconds, or 3 Minutes 27 Seconds., This subtracted from the Moon's Place, first equated, leaves 2. 22. 44. 45. for the Place of the 2d Equation.



The next Equation being very easie, the Reader is desired to see Page 25th, of the other Book, and from thence to pass on to the Middle of the 27th Page; since there is a Mistake, occasion'd by a Misunderstanding of Mr. Flamsteed. Of which hereafter.

When the Moon's 3d Equation has been found, from the Sun's true Place subtract the Place of the Moon's Apogee first æquated; and in the Table of the Equation of the Apogee, you will find the proper Equation to be added to, or subtracted from the Place of the Apogee, before found, according as the Titles direct. Then again subtract this last Place of the Apogee from the Sun's true Place, and in the same Table will be found the proper Excentricity.

I desire, That this last may be carefully remembered; for if from the Sun's Place, instead of this, the first æquated Place of the Apogee be subtracted, as is usual in this Case, a great Error will ensue. Therefore this Caution may be sufficient.

Having gone thus far, the Reader may please to proceed to the Middle of Page 27th of the Address, where he is directed to find the Moon's mean Anomaly, and the 4th Equation, without a Table of the Equations of the Moon's Center, which is needless, since it may be done as speedily, and with less Danger of Mistakes without it. Thus in the first Observation, where the Moon's mean Anomaly is 7. 13. 09. 53. the half is 3. 21. 34. 56. the Supplement to 180 Deg. is 68. 25. 04. the Tangent whereof is 10; 402778. the Excentricity is 50221. this added to 1000000. the Moon's mean Distance from the Earth, makes 1050221, and subtracted from it leaves 949779. To find the Logarithm of the former proceed thus, the Logarithm of 1050 is 3. 021189, and the Difference

ference between that and the next is 414: Therefore, if 1000 give 414, what will 221 give? *Answer* is 91, which added to 021189, makes 021280, the *Index* must be 6, because the *Natural Number* has 7 Places. The *Logarithm* therefore will be 3. 978719 6. 021280. *Complement Arithmetical* 3. 978719. The *Logarithm* of 9497 is 3. 977586, and the Difference is 46. Then if 100 give 46; 79 will give 36. This added to 3. 977586, makes 5. 977622. for the *Logarithm* of 949779. The *Tangent* of 68. 25. 04. is 10. 402778. The *Tangent* 10. 359119 is that of 66. 22. 31. this subtract from 68. 25. 04. leaves 2. 02. 33. which doubled makes 4. 05. 06. for the 4th *Equation*, which is to be added, because the mean *Anomaly* is above 6 *Signs*.

For the three last *Equations* I refer the Reader to *Pages* 28 and 29 of the *Address*: But it is to be observed, that in the 23d *Line* of the 29th *Page*, instead of 2 *min.* 10 *Seconds*, it ought to be 2 *minutes* 20 *Seconds*. The Fifth *Equation* is managed like the 2d; only whereas there, when 3 *Figures* were cut off, the *Divisor* was 54, here it must be 9; because 2 *Degrees* and a half make 9000 *Seconds*. There will be no Occasion to reduce the *Moon's* true Place thus found in her *Orbit*, to the *Ecliptic*, in finding the *Longitude* of Places; because it is that, which is likewise to be found by taking an *Observation* with the *Instrument*, the Manner of performing which, will quickly be explained: But before that, I come now (as was before promised) to anticipate some *Objections*, that may possibly be raised. And the only seeming one against my Table of *Excentricities*, or even against the whole *Work* may be, That I make the greatest *Excentricities* too small; since by the Table in Mr. *Whiston's Astronomical Lectures* the greatest is 66854; and Sir *Isaac Newton's*, according as it is printed in Dr. *Gregory's Astronomy* is 66782; whereas the greatest of mine is but 61946. This (tho' at first it may seem material, yet) when well consider'd, will be found to have no Weight, but the contrary.



I. It must be granted, that *Hypotheses* and *Theories* ought to be made from, and directed by *Experiments* and *Observations*; not the latter from or by the former. Now in all these *Observations*, the Errors in finding the *Moon's* Place are but little, if compar'd with the other.

II. Supposing the Numbers in Mr. *Whiston's* Book to answer sometimes, yet at other Times they are vastly wrong, and because, that Method wants many of Sir *Isaac Newton's* necessary *Equations*, neither the Method nor the Numbers can be safely depended on.

III. Since it is Sir *Isaac Newton's* Theory I have espoused, and throughout closely adher'd to, I must take such *Excentricities*, as will answer the *Observations*. Now those will be found at a mean Distance of the *Sun*, viz. near 45 Degrees from the *Moon's* true *Apogee* or *Perigee* to be very near true; that is, when the *Excentricities* are 52000, or thereabouts; but when they are great or little, that is, when the *Sun* is very near the true *Apogee* or *Perigee* of the *Moon*, or near at a *Quadrature* from them, especially the former; they are always wrong: In the first Case too great; and in the 2d, too little. For the Truth of this, the Reader may be pleas'd to have Recourse to the 3. 6, 7, 8, 9, 11, 14, 16, 17, 18, 27, 29 *Observations*; where he will find the *Excentricities* too great; and to be the only Occasion of so great Errors. Likewise in the 5, 10, 21, 23, and 26 *Observations*, he will find the Reason of the Errors to be, that the *Excentricities* are too little.

IV. And above all it is to be remembred, that in order to find the *Excentricity*, from the *Sun's* true Place was subtracted, not the 1st æquated, but the 2d or true Place of the *Moon's* *Apogee*: As is done also to find the *Moon's* mean *Anomaly*, by subtracting from the *Moon's* Place 3d Time æquated, the Place of the *Apogee*, the 2d and not the 1st Time æquated. For that is certainly the Way to find the true Distance of the *Moon* from the true *Apogee*. As the other is to find the true Distance of the *Sun* from the same; and so to find the true *Excentricity*: Thus,

for Instance ; suppose the *Sun's* Place to be 5. 12. 36. 16. the Place of the *Apogee* 1st æquated, 3. 21. 36. 16. the Difference is 1. 21. 00. 00. for which the *Equation*, according to Dr. *Gregory*, is + 12. 18. 15. and the *Excentricity* is 53846. By my Table the *Equation* is + 12. 15. 04. and the *Excentricity* 49191. This would be too little : But when 12. 15. 04. is added to 3. 21. 36. 16. the Sum will be 4. 03. 51. 20. This subtracted from 5. 12. 36. 16. leaves 1. 08. 44. 56. The *Excentricity* answering to which, in my Table is 53655. nearly the same with Dr. *Gregory's*, viz. 53846. But supposing the *Sun's* Place as before, 5. 12. 36. 16. and the 1st Place of the *Apogee* to be the same, or 11. 12. 36. 16. here the *Equation* being nothing, the *Excentricity* in Dr. *Gregory* would be insufferably too great to answer any true *Observation*. I say, to answer any true *Observation* ; because I could produce several of the most industrious, and justly celebrated Royal Astronomer Mr. *Flamsteed*, as we find them printed in his *Historia Cælestis Britannica*, which are most certainly wrong, and cannot be reconciled to Truth any other Way, than by taking an *Excentricity* much greater than 66782, even near 69000. To make this appear, I shall give one only Instance drawn out at large, as before, Page 545. Vol. 2. Wherein the Error by Sir *Iaac Newton's* Account amounts to ( I do not say 7 or 8 *Minutes* of *Motion*, as the great Dr. *Halley* has found it to do, sometimes by his *Observations*, but to) even near 15 *Minutes*. Please to take it here, as follows.





*A. D.* 1714, *Sept.* 6. <sup>D.</sup> 06. <sup>H.</sup> 35. <sup>M.</sup> 12. <sup>S.</sup> + 22. *viz.* 34. Sun's mean Motion,  
 5. 26. 16. 42. Sun's Apogee, 3. 07. 58. 52. Mean Anom. 2. 18. 17. 50.  
 Eq. Orbit, - 1. 53. 16. Eq. Time, - 5. 37. Proportional Parts, - 14.  
 Sun's true Place, 5. 24. 23. 12. Mean Time, 6. 29. 57.

| Moon's Eq. | Moon's mean Motion                                                 | Moon's Apogee.                                                                                                 | Ascending Node.                                                                                                |
|------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
|            | 9. 11. 20. 45.<br>+ 11. 30.                                        | 5. 25. 02. 34.<br>- 19. 28.                                                                                    | 8. 02. 46. 27.<br>+ 9. 15.                                                                                     |
| 1 Eq.      | 9. 11. 32. 15.<br>+ 03.                                            | 5. 24. 43. 06.<br>- 6. 58.                                                                                     | 8. 02. 55. 42.<br>- 1. 02. 00.                                                                                 |
| 2 Eq.      | 9. 11. 32. 18.<br>- 32                                             | 5. 24. 36. 08.<br><i>Excent.</i> 61940.                                                                        | 8. 01. 53. 42.<br><i>Inc. Limit.</i> 2. 25.                                                                    |
| 3 Eq.      | 9. 11. 31. 46.<br>- 6. 54. 22.                                     | <i>Moons Mean Ano.</i><br>3. 16. 55. 38.                                                                       | <i>Vert. Diff. M's. high-</i><br><i>er Limb.</i> 73. 03. 50.                                                   |
| 4 Eq.      | 9. 04. 37. 24.<br>- 11. 25.                                        | <i>Sept. 6, at Noon,</i><br><i>S's. Pla.</i> 5. 24. 07. 07.                                                    | <i>Error Div.</i> + 32.<br><i>Error Wall</i> - 14. 10.                                                         |
| 5 Eq.      | 9. 04. 25. 59.<br>- 9.                                             | <i>R. A.</i> 174. 36. 10.<br><i>Sun's Place at Night,</i><br>5. 24. 23. 12.                                    | <i>Refract.</i> + 2. 39.<br><i>Sem. Moon</i> + 15. 59.                                                         |
| 6 Eq.      | 9. 04. 25. 50.<br>- 2. 18.                                         | <i>R. A.</i> 174. 50. 56.<br><i>Diff. R. A.</i> 14. 46.                                                        | <i>Vert. Diff. M's. Cent.</i><br>73. 08. 50.                                                                   |
| 7 Eq.      | 9. 04. 23. 32.<br><i>Reduct.</i> - 5. 57.                          | <i>R. A. Moon's Center,</i><br>273. 44. 26.                                                                    | <i>Par. Alt.</i> - 55. 33.<br><i>True Alt. M's. Cent.</i><br>17. 46. 43.                                       |
| Long. Cal. | 9. 04. 17. 35.                                                     | <i>Hor. Par. Syz.</i> 58. 52.                                                                                  | <i>C. Lat.</i> 38. 31. 30.                                                                                     |
| Long. Obs. | 9. 03. 30. 06.                                                     | <i>Prop. Hor. Par.</i> 58. 03.                                                                                 | <i>Greenwich.</i>                                                                                              |
|            | <i>Diff.</i> + 47. 29.<br>or $1424 \frac{1}{2}$ Miles<br>too much. | <i>Wh. M's. mean Ano.</i><br>3. 16. 43. 25.<br><i>Excent.</i> 66849.<br><i>Moon's Place,</i><br>9. 03. 51. 13. | <i>Dec. S. M's. Center,</i><br>20. 44. 47.                                                                     |
|            |                                                                    | <i>Diff.</i> + 21. 07.<br>or $633 \frac{1}{2}$ Miles<br>too much.                                              | <i>Greg. m's mean An.</i><br>3. 16. 55. 39.<br><i>Excent.</i> 66775.<br><i>Moon's Place,</i><br>9. 03. 44. 39. |
|            |                                                                    |                                                                                                                | <i>Diff.</i> + 14. 33.<br>or $436 \frac{1}{2}$ miles<br>too little.                                            |

Perhaps

Perhaps some sort of Persons may here be apt to object, that tho' by these two Accounts the Error is very great, yet mine far exceeds them: But it is presumed no Man of Sense will make himself so ridiculous, as to start such an one; because it is plain, that to a false *Observation* a false *Theory* may very probably answer nearer, than a true one; and tho' a false *Theory* may be made from true *Observations*, yet from false ones it is not possible to frame a true *Theory*.

The next *Observation* but one in the same *Page*, namely, *September, 10 D. 10 H. 17 M. 33 + 24 S.* is nearly as wrong, which Errors I can impute to nothing else, but to his Clock, which was 3 *Min. 40 Sec.* too fast in the first *Observation*, and 4 *Min. 30 Sec.* in the Second: Tho' by the true Tables of the *Equation of Time* (very ingeniously made by himself,) in the 1<sup>st</sup> it ought to have been 5. 37. and in the other 7 *Min. 03 Sec.* too slow. Now the Time being taken too much, advances the *Moon* so much by Calculation more forward in it's *Orbit*, than it was by *Observation*, and makes the Difference in *Latitude* to be at least 5 *Minutes*, which is intolerable.

And here, I hope, I may not be accus'd of Presumption or ill Manners, but rather excused; if for my own Vindication (tho' with much Reluctancy) I am forced to speak the Truth. The learned Royal Astronomer Dr. *Halley*, was pleased to ask me, *Why I differ'd from Mr. Flamsteed in finding the Moon's Place?* Therefore, with due Submission, I desire He will be pleased to accept of my Answer here; which is this.

The *Moon's* gteatest *Latitude* is determined by Sir *Isaac Newton* to be 5 deg. 17 min. 20 sec. and by no Astronomer, (that I have heard of,) to exceed 5 deg. 18 min. But finding in the latter End of Mr. *Flamsteed's* Second *Volume*, in his Table of the *Moon's* Places deducted from his *Observations*, that the *Latitude* exceeded this in a great many Places, viz. 94, and in several amounted to above 6 *Degrees*, I was much astonish'd,

and



and forced to suspect, that either the *Observations* were wrong, or the *Longitudes* and *Latitudes* falsely calculated from the right Ascensions and Declinations given. This latter Suspicion I found, by Examination, to be truly grounded in many Cases; as any Person, that understands *Spherical Trigonometry*, may easily prove. But here occurs another Thing I cannot but wonder at, *viz.* That Mr. *Flamsteed* should offer to find the true Place of the *Moon* from a false right Ascension. This he has done all along, if those right Ascensions be adapted to the true apparent Times of the *Observations*, which are placed over-against them, and not to those Times, as corrected in *Pages* 134, and 135, of his *Prolegomena*. I made no Question, but he had thus corrected them, or else would not have put over-against the false Mean Time by his Clock, the true Apparent Time, as he calls it, and has again placed throughout over-against the right Ascensions of the *Moon's* Center. As I told the learned Secretary to the ROYAL SOCIETY, Mr. *John Machin*, Professor of *Astronomy* at *Gresham College*, *This Inaccuracy, from so great a Man, might easily lead any Person into a Mistake; as it did me, and was the sole Occasion of that mention'd in the 79th Page, and of that in Page 19th, Lines 30, and 36, of the Address, which occasion'd the Observations thereunto annex'd, to be grounded, (tho' exactly true to a Second of Motion, according to that Supposition,) upon a wrong Foundation.* This Mistake I hope the Candid Reader will wink at, being thus pardonably, or, if you please, inevitably occasion'd.

I might have produced other Instances of false *Observations*, or at least of *Observations* falsely printed; as in *Page* 354th, in the Year 1698, *Aug. 8 day, 9 h. 40 min. 19 + 23 sec.* where the *Calculation* exceeds the *Observation* by no less than 46 deg. 30 min. and 17 sec. and the *Latitude* is less by 14 min. and 22 sec. But lest this should seem to be done more by Way of Censure, than of my own Vindication, I shall desist; only shall further say, That this justifies the Remark I made at the Bottom of *Page* the 23d of the *Address*, whither I refer the Reader; to whom, I think, I have given all necessary Directions, in order to render  
the

the Calculation as speedy and easy, as is possible. And shall therefore now proceed to shew, how by the *Hypsometer* to take and work an *Observation*.

If I had found, that Capt. *Rowe's* Fluid *Quadrant*, which is fully described in the other Book, and for which ingenious Thought I understand he was amply rewarded, would have answer'd Expectation, I should never have set my Thoughts upon inventing another; but the Bubble of *Air* is so long in settling even upon a fixed Post, that it cannot possibly answer at Sea. Therefore I must ask the Reader's Excuse, whilst I add a few Words to what was said of this new Instrument, at the Beginning of this Book.

It needs not to be above 4 Inches Square, since that may contain Wheels strong enough to turn about such a Table, as is there described; and the Figur'd Circle may be but of 6 or Inches *Diameter*: For if diagonally divided, it will plainly enough distinguish *Seconds*. It is now so contriv'd, that one Man may take an *Observation* Day or Night with all imaginable Speed and Certainty, after this Manner. A hollow Staff, to be rais'd or depress'd at Pleasure, according to the Line of Sines before set down, is put upon cross Centers, like a *Mariner's* Compass; and the Top of this Staff is set exactly under the Center of Gravity of the Instrument, so that, unless in a Storm, when no *Observation* can be suppos'd to be taken, it will always be truly perpendicular every Way. Mine is so exact, that whatever Way it be inclin'd, if not with too great Violence, (as a Ship in a Storm,) no Liquor will be spill'd out of a Glass fill'd Brim-full; which proves it to be always truly *Horizontal*. The Instrument is turn'd by a Socket on the Top of the Staff to any *Azimuth*; and a *Quadrant* is affix'd to it, to set the *Telescope* to any *Degree* of *Altitude*, and afterwards taken off, that it may remain exactly ballanced: Perhaps there may be no great Occasion for *Night-Observations*, since both *Sun* and *Moon* may be seen at the same Time, except near their *Conjunction* and *Opposition*.

Here



Here it comes into my Mind to say something about the first Method in the other Book, of finding the *Moon's* Place by Night; (see *Page* the 8th of the *Address*) and I cannot but think, that Way may be made very Practicable, if the perpendicular *Thread* be fasten'd truly *parallel* to the two Sides, and a *Spirit-Level* be put under it, to shew when it is exactly *perpendicular*. But to return to the *Hypsometer*;

When any *Observation* is to be taken, set the Instrument upon the Staff, and having put on the *Tube*, raise it, without the Handle, to the *Object*, and there fasten it; then put on the *Quadrant*, and see to what *Altitude* the *Tube* is rais'd, as suppose to about 40 *Degrees*; if the *Object* be ascending, set the *Tube* by the *Quadrant* exactly to 39 *Degrees*; but, if descending, to 38, having before turn'd the Handle back, as far as it will go. Then take off the *Quadrant*, which having done, turn the Handle leisurely about, till the *Horizontal Hair* or *Fine Wire* cuts the *Star*, or the lower *Limb* of the *Sun* or *Moon*, and see where the Handle stands; then turn the Handle further till the *Hair* cuts the higher *Limb*; and immediately let the *Half Minute-Glass* be turn'd, or having a little before set a true *Moving-Watch* a going, (no Matter to what Time) look at the *Minute*, and (as near as you can) the *Second*, and write them down, and having carefully counted upon the *Figur'd Circle* the Places of both *Observations*, you will have the true *Altitudes* of both, and by that Means of the *Center*; allowing for the *Ascent* or *Descent* of the *Object* in the mean Time. The *Altitude* of the *Sun* or *Star* may be taken either before or after that of the *Moon*, if the Time betwixt the *Observations* be exactly determin'd by the *Watch*. So that one Instrument, and one Observer may be sufficient.

Knowing the *Hour* of the *Day* by the *Sun*, and of the *Night* by the *Star*, together with the *Latitude* of the *Place*, and the *Altitude* of the *Moon* exactly at that Time, it will not be difficult to find the Place of the *Moon* in it's *Orbit*, and so to compare it with the Place found by Calculation,

How

*How to find the H O U R by the S U N.*

First reduce the reckoned Time, as near as you can think, to the *Meridian* of *Greenwich* (this may be corrected afterwards) and find the true Place of the *Sun*, as also his *Declination* and right *Ascension*. Thus for Example; in the *Latitude* 53, 27, 52 *North*, on the 9th of *January*, 1731, I found by the Instrument the apparent *Altitude* of the *Sun's* Center to be 13 Deg. 46 Min. 16 Sec. and the Refraction 3, 17 being subtracted, the true *Altitude* 13, 42, 59 being past the *Meridian*. The *Sun's* Place at Noon (allowing 10 Minutes, 40 Seconds, for the supposed Distance of the *Meridian's*) was 10, 00, 03, 33. It's Distance from the nearest *Equinoctial* Point 59, 56, 27. Then

1. *To find the SUN's Declination.*

As Radius ———— 10. 000000

To the Sine of 59. 56. 27. ———— 9. 937271

So is the Sine of 23. 29. 00. ———— 9. 600409

To the Sine of 20. 10. 30. ———— 9. 537680

2. *To find the Right ASCENSION.*

As to Co. Tang. of 59. 56. 27. ———— 9. 762475

Is to Radius ———— 10. 000000

So is the Co. Sine of 23. 29. 00. ———— 9. 962453

To the Tang. of 57. 44. 55. ———— 10. 199978

This subtracted from 360 deg. leaves 302. 15. 05. for the *Sun's* right *Ascension*

3. To



## 3. To find the HOUR.

Here are three Sides given of an Oblique Spherical Triangle, namely ;  
 36. 32. 08. Comp. Lat. 110. 10. 30. Sun's Distance from the North  
 Pole, and 76. 17. 01. the Comp. of the true Altitude, to find the Angle  
 contain'd between the two first ; thus,

|                   |              |                  |                |            |
|-------------------|--------------|------------------|----------------|------------|
| Side              | 36. 32. 08.  |                  |                |            |
| Side              | 110. 10. 30. | Comp. Arith. S.  | 36. 32. 08. —  | 0. 235248  |
| Side              | 76. 17. 01.  | Comp. Arith. S.  | 110. 10. 30. — | 0. 027499  |
|                   |              | Sine of Half Sum | 111. 29. 49 —  | 9. 968687  |
| Sum               | 222. 59. 39. | Remainder Sine   | 35. 12. 48. —  | 9. 760891  |
| $\frac{1}{2}$ Sum | 111. 29. 49. |                  |                |            |
|                   | 76. 17. 01.  |                  | Sum            | 19. 982505 |
|                   |              |                  |                | 9. 991252  |
| Rem.              | 35. 12. 48.  |                  |                |            |

This 9. 991252 is the *Co-sine* of 11. 27. 42: which doubled makes 22. 55. 24 ; and this reduced allowing for an Hour 15 Deg. and so proportionally for *Minutes* and *Seconds*,) gives 1 Hour 31 *Minutes* and 42 *Seconds*, which was the true Time of the Day.

## To find the HOUR of the NIGHT by a STAR

On the same Night, viz. Jan. 9th, 1731, the *Altitude* of *Aldebaran*, or the *Bull's Eye* was on the *East* of the *Meridian* 46. 36. 13 Comp. Alt. 43. 23. 47. Refraction + 0. 45. True Vertical Distance, 43. 24. 32.

In the 1st Place the true right *Ascension* of the Star, must be found by the Rules in the 49th Page of the *Address* ; and it was 65. 07. 09. Likewise the *Declination* was found to be 15. 56. 18. it's *Complement* or *Polar Distance* 74. 03. 42.

N. B. This Method must always be used to find the Time or Latitude by any *Star*; otherwise you work in vain. Then as before;

|                   |              |                   |               |            |
|-------------------|--------------|-------------------|---------------|------------|
| Side              | 36. 32. 08.  | Comp. Arith. Sine | 36 32. 08. —  | 0. 225248  |
| Side              | 74. 03. 42.  | Comp. Arith. Sine | 74. 03. 42. — | 0. 017025  |
| Side              | 43. 24. 32.  | Sine of Half Sum  | 77. 00. 11. — | 9. 988729  |
| <hr/>             |              | Sine of Remainder | 33. 35. 39. — | 9. 742965  |
| Sum               | 154. 00. 22. |                   |               |            |
| $\frac{1}{2}$ Sum | 77. 00. 11.  |                   |               |            |
|                   | 43. 24. 32.  |                   |               |            |
| <hr/>             |              |                   |               |            |
| Rem.              | 33. 35. 39.  | Sum               |               | 19. 973967 |
|                   |              | Half Sum          |               | 9. 986983  |
|                   |              |                   |               | <hr/>      |

This 9. 986983 is *Sine Comp.* of 13. 57. 31. This doubled is 27. 55. 02. from 65. 07. 09. the *Star's* right *Ascension*, subtract 27. 55. 02. there remains 37 12. 07. This was the right *Ascension* of the *Mid-heaven* at the Moment of taking the *Star's* *Altitude*; from which subtract 302. 15. 05. the *Sun's* right *Ascension* at Noon; or from that + 360, viz 397. 12. 07. there remains 94. 57. 02.

This reduced into Time, (allowing 15 Degrees to an Hour, &c.) makes 6 Hours, 19 Minutes, 44 Seconds; but this is too much. For in a Solar Hour there pass the *Meridian* not only 15 Deg. but also the 24th Part of the Difference of the *Sun's* right *Ascension* in 24 Hours. This ought always to be remembred in finding the Time by a *Star*, tho' not by the *Sun*, or else the Time will be taken false. To avoid which do thus, Look in the Table of the *Horary* Motion of the *Earth* for the *Sun's* mean *Anomaly*, and you will find 2 Min. 23 Sec. Then say, If 15 Deg. 02 Min. 33 Sec. or 54 153 Seconds, give 60 min. or 360 Sec. what will 94. 57. 06, or 341326 Seconds give? Answer 22724, which reduced is 6 Hours, 18 Minutes, 44 Seconds, and that was the exactly true Time of the Night, when the *Altitude* of *Aldebaran* was taken. And this may suffice for all *Observations* by a known fix'd *Star* for finding the Time of the Night.



*How to find the MOON'S Place by OBSERVATION:*

This is that great and necessary PROBLEM for finding the *Longitude* of any Place upon the *Ocean*, which hitherto has been esteemed very difficult, or even impracticable; and has therefore put *Astronomers* upon that other Method by the Occultation of fixed *Stars* by the *Moon*; which is both much more difficult and uncertain, and also but seldome to be put in Practice, if compar'd with this. which may be used either Night or Day,, at any Time, almost, at Pleasure; and by the *Sequel* will be found sufficiently easy and true, even to a Demonstration.

First, Therefore let the *Latitude* of the Place be found by some of the Ways before shown at the Beginning of this Book, and in the 8th and following *Pages* of the other Book; and also let the Time be very carefully found by the Instrument, which, (if due Care be used) is sufficient for the Purpose; and let the *Altitude* of the *Moon's* Center be also observed.

Having these Three given, it will not be difficult to solve the *Problem*.  
\* Thus for Example;

At *Winwick* in *Lancashire*, Latitude North, 53. 27. 52. in the Year 1731, Jan. 11 Day, 16 Hours, 36 Minutes, 47 Seconds; and 10 Minutes 40 Seconds, for the supposed Difference of *Longitude* West from *Greenwich*. The Time is 11 Days, 16 Hours, 47 Minutes, 27 Seconds. The *Altitude* of the *Moon's* Center was observed to be 25. 56. 38. Subtract the *Refraction* 1. 40. Remains 25. 54. 58. Add the *Parallax* of *Altitude* 48. 54. (the *Horizontal Parallax* being then 54. 23.) the true *Altitude* was 26. 43. 52. Vert. Distance, 63. 16. 08.



To make it as useful and easy, as possible, for *Mariners* in all other Cases, I shall here give them the Calculation at large.

|                   |                   |                         |                 |
|-------------------|-------------------|-------------------------|-----------------|
| <i>A. D.</i> 1721 | 9. 20. 52. 54.    | Mean Mot. of the Apogee | 3. 08. 05. 30.  |
| Years 10          | 11. 29. 34. 57.   |                         | 10. 30.         |
| January 11        | 10. 50. 32.       |                         | 2.              |
| Hours 16          | 39. 25.           |                         | 3. 08. 16. 02.  |
| Minutes 47        | 1. 56.            |                         | 10. 01. 59. 45. |
| Seconds 27        | 1.                | Sun's mean Anomaly      | 6. 23. 43. 43.  |
|                   | 10. 01. 59. 45.   |                         | + 3. 09.        |
|                   | Eq. Or. + 47. 32. |                         | + 9. 11.        |
|                   | 10. 02. 47. 17.   | Equation of Time +      | 12. 20.         |
|                   | Pro. Parts + 31.  |                         |                 |
| Sun's true Place  | 10. 02. 47. 48.   | R. Ascension at Noon    | 304 21. 47.     |
| S's Pl. at Noon   | 10. 02. 05. 36.   | Hours 16                | 240. 00. 00.    |
|                   |                   | Minutes 36              | 9. 00. 00.      |
| R. A. at Noon     | 304. 21. 47.      | Seconds 47              | 11. 45.         |
| R. A. at Night    | 305. 05. 26.      | Diff. right Asc.        | 43. 39.         |
| Diff. of R. A.    | 43. 39.           |                         | 554. 17. 11.    |
|                   |                   |                         | 360. 00. 00.    |
|                   |                   | R. A. of the Mid-heaven | 194. 17. 11.    |





To find the MOON'S PLACE by CALCULATION for 1731,  
January 11 Days, 16 Hou. 59 Min. 47 Sec. Mean Time.

| Moon's Eq. | Moon's Mean Motion.         | Moon's Apogee.                      | Ascending Node.                       |
|------------|-----------------------------|-------------------------------------|---------------------------------------|
|            | 4. 03. 21. 57.<br>— 4. 49.  | 4. 00. 18. 37.<br>+ 8. 10.          | 9. 16. 33. 22.<br>— 3. 53.            |
| 1 Eq.      | 4. 03. 17. 08.<br>— 19.     | 4. 00. 26. 47.<br>+ 49. 20.         | 9. 16. 29. 29.<br>+ 47. 17.           |
| 2 Eq.      | 4. 03. 16. 49.<br>+ 25.     | 4. 01. 16. 07.<br>Excent. 61898.    | 9. 17. 16. 46.<br>Inc. Limit. 16. 35. |
| 3 Eq.      | 4. 03. 17. 14.<br>— 14. 06. | Moon's mean Anom.<br>0. 02. 01. 07. |                                       |
| 4 Eq.      | 4. 03. 03. 08.<br>+ 20.     |                                     |                                       |
| 5 Eq.      | 4. 03. 03. 28.<br>+ 51.     |                                     |                                       |
| 6 Eq.      | 4. 03. 04. 19.<br>+ 00. 00. |                                     |                                       |
| 7 Eq.      | 4. 03. 04. 19.              |                                     |                                       |

Lastly, from the aforefaid DATA, to find the Moon's Place in her Orbit by Observation. In Figure the 4th of the Table in the other Book Triangle  $\triangle A E$  right Angle at  $\angle E$  there are given the Angle  $\angle A E$  always 23 Deg. 29 Min. and the Side  $\angle A$  here 14. 17. 11.. To find  $\angle E$  see Page 10th.

As the Tang. of — 14. 17. 11. — 9. 405933.  
Is to Radius — — — 10. 000000.  
So is the Co-Sine of — 23. 29. 00. — 9. 962453.  
19. 962453.  
To the Tang. Comp. of 15. 31. 00. — 10. 556520.

So then *Libra* 15. 31. 00. was on the Meridian.

2. To

2. To find  $\text{Æ E}$ .

|                   |   |            |             |
|-------------------|---|------------|-------------|
| As Radius         | — | —          | 10. 000000. |
| To the Sine of    | — | 15. 31. 00 | 9. 427354.  |
| So is the Sine of | — | 23. 29. 00 | 9. 600409.  |
| To the Sine of    | — | 6. 07. 10  | 9. 027763.  |

Which in this Case is to the *South* of the *Equinoctial*.

3. To find  $\text{Æ E A}$ .

|                   |   |            |             |
|-------------------|---|------------|-------------|
| As Radius         | — | —          | 10. 000000. |
| To the Sine of    | — | 23. 29. 00 | 9. 600409.  |
| So the Co-Sine of | — | 14. 17. 11 | 9. 986357.  |
|                   |   |            | 19. 586766. |
| To the Co-Sine of | — | 67. 17. 03 | 9. 586766.  |

*Note*, That this *TRIANGLE* lies to the *South* of the *Equinoctial*  $\text{Æ A}$ .

The Place of the *Ascending Node* was found to be in 9. 17. 16. 46. therefore the *Descending Node* was 3. 17. 16. 46. and to the *West* of the *Meridian*. Therefore from 6. 15. 31. 00, the Point of the *Ecliptick* then on the *Meridian*, subtract 3, 17, 16, 46, there remains 2, 28, 14, 14, for the Side  $\text{E F}$  in the *Triangle*  $\text{E M F}$  which in this Case lies to the *South* of the last *Triangle*, and both to the *West* of the *Meridian*, in which are given, as before, the Side  $\text{E F}$  2, 28, 14, 14, the *Angle*  $\text{E F M}$  viz. the *Angle* of the *Limit*. 5, 16, 35, and the *Angle*  $\text{F E M}$  the Supplement of  $\text{Æ E A}$  (which was 67, 17, 03, to 180 *Degrees*; namely, 112, 42, 57. It is required to find the Sides  $\text{F M}$ ,  $\text{E M}$ , and the *Angle*  $\text{E M F}$ .

|                |              |                                 |             |
|----------------|--------------|---------------------------------|-------------|
| $\text{FEM}$ — | 112. 42. 57. | The Side $\text{E F}$           | 88. 14. 14. |
| $\text{EEM}$ — | 5. 16. 35.   | Half $\text{E F}$               | 44. 07. 07. |
| Sum —          | 117. 59. 32. |                                 |             |
| Half Sum       | 58. 59. 46.  |                                 |             |
| Diff. —        | 107. 26. 22. | Here having 2 <i>Angles</i> and |             |
| Half Diff      | 53. 43. 11.  | the interjacent Side given, to  |             |
|                |              | find the other 2 Sides; the     |             |
|                |              | Proportions are;                |             |

As



Co. Arith.

1. As the *Sine* of 1 half Sum of the *Angles* 58. 59. 46. — 0. 066952  
 To the *Sine* 1 half the *Difference* — 53. 43. 11. — 9. 906406  
 So is the *Tang.* of 1 half the Side E F. 44. 07. 07. — 9. 986637  
 To the *Tang.* of 1 half Diff. of the Sides 42. 21. 53. — 9. 959995
2. As the *Co-sine* of 1 half the Sum of *Angles* 58. 59. 46. — 0. 288112  
 To the *Co-sine* of 1 half the *Difference* 53. 43. 11. — 9. 772127  
 So is the *Tang.* of 1 half the Side E F 44. 07. 07. — 9. 986637  
 To the *Tang.* of 1 half Sum of the Sides 48. 05. 10. — 10. 046876

The Half *Difference* added to the Half Sum gives the greater Side F M 90, 27, 03, and subtracted from it, gives the lesser Side E M 5, 43, 17. Then to find the *Angle* E M F.

Co. Arith.

- As the *Sine* of E M — 5. 43. 17 — 1. 001333  
 To the *Sine* of E F M — 5. 16. 35. — 8. 963601  
 So is the *Sine* of E F — 88. 14. 14 — 9. 999794  
 To the *Sine* of E M F — 67. 13. 10. — 9. 964728

Lastly, in the *Triangle* Z M G having the *Angle* at M acute, there are given the Side Z G 63, 16, 08, the Complement of the *Moon's* true *Altitude*, the *Angle* Z M G 67, 13, 10, and the Side Z M the Distance in the *Meridian* from the *Zenith* to the Point of the *Moon's* Orbit, which was in the *Meridian* = Z Æ + Æ E + E M, viz. 53, 27, 52 + 6, 07, 10 + 5, 43, 17, = 65, 18, 19, to find first the *Angle* M G Z, afterwards the Side M G.

For the First.

Co. Arith.

- As the *Sine* of M G — 63. 16. 08. — 0. 049087  
 To the *Sine* of Z M G — 67. 13. 10. — 9. 964728  
 So is the *Sine* of Z M — 65. 18. 19. — 9. 958347  
 To the *Sine* of M G Z — 69. 42. 14. — 9. 972162

For the Second.

Here having two Sides and their opposite *Angles*, to find the *interjacent* Side, is the last but two inverted. Thus,

1. As

|                                                                |               |            |
|----------------------------------------------------------------|---------------|------------|
| 1. As the <i>Sine</i> of 1 half the Diff. of the <i>Angles</i> | 01. 14. 32. — | 1. 663967  |
| To the <i>Sine</i> of 1 half the Sum — —                       | 68. 27. 42. — | 9. 968563  |
| So is the <i>Tang.</i> of 1 half the Dif. of Sides             | 01. 01. 05. — | 8. 249690  |
| To the <i>Tang.</i> of 1 half the Side - - -                   | 37. 19. 35. — | 9. 882220  |
| 2. As the <i>Co-sine</i> of 1 half Dif. of the <i>Angles</i>   | 01. 14. 32. — | 0. 000102  |
| To the <i>Cofine</i> of 1 half the Sum — —                     | 68. 27. 42. — | 9. 564812  |
| So is the <i>Tang.</i> of 1 half the Sum of Sides -            | 64. 17. 13. — | 10. 317360 |
| To the <i>Tang.</i> of 1 half the Side - - -                   | 37. 19. 35. — | 9. 882274  |

When the *Tangents* of half the interjacent Side come out not exactly the same, (as often happens in this Case,) take their Difference. So here from 9,882274 subtract 9,882220, their Diff. 9,882254, is the true *Tangent* of half the Side, viz. of 37, 19, 35, this doubled makes 74, 39, 10, for the Side M G, which subtracted from 6, 17, 43, 49, the Point of the *Moon's Orbit* o the *Meridian* leaves 4, 03, 04, 39, for the Place of the *Moon* in her *Orbit* by *Observation*. The Place of the *Descending Node* was found to be 3, 17, 16, 46, to which add the Side F M 3, 00, 27, 03, it makes, as before, 6, 17, 43 49.

The Place of the *Moon* by *Observation* here exceeds that by the *Calculation* 20 *Seconds*; which shews that the supposed Time at *Greenwich* was too little. Look in the *Table* of the *Horary Motion* of the *Moon*, for its *Mean Anomaly*, and you will find 30, 26. Then if 30, 26, give 60 *Minutes*; what will 20 *Seconds* give? Answer 39 *Seconds*. This added to the reckoned or supposed Difference of *Meridians*, in Time before taken, 10 *Min.* 40 *Sec.* (so it should have been express'd in the 10th *Page* of the *Address*, being so meant,) gives 11 *Min.* 19 *Seconds*. Then if 60 *Min.* give 15 *Degrees*; what will 11, 19, give? Answer 2 *Deg.* 50 *Min.* the Difference of *Longitude*, as in the *Page* aforesaid.



But here it will be objected; *If the Time was taken wrong 39 Sec. then the Sun's Place, right Ascension, Moon's Place by Observation were all taken wrong*: This I grant; a little wrong; but may easily be corrected thus; The *Sun's Horary Motion* being 2. 23, he would in 39 Sec, have been advanced further in the *Ecliptic* 2 Seconds, and as much in his right *Ascension*, so much also would the *Culminating Point* of the *Moon's Orbit* be more forward; and the Side *M G* remaining the same, or considerably different, the *Moon's Place by Observation* was 4. 05. 04. 41, will make the Difference in Time 4 Seconds more, viz. 11 Minutes 23 Seconds, and the Difference of *Longitude* between the *Royal Observatory* at *Greenwich* and *Winwick* to be 2 Degrees and 51 Minutes; and so I do here determine it.

Perhaps the *Mariner* seeing here so many Proportions to be wrought, before he can obtain his End, may be discouraged: But I cannot help it, since the Nature of the Thing does not suffer it to be made more speedy and easy. Yet surely an Hour or two, once a Week, or perhaps once a Fortnight, till he arrives near his Port, ought not to be grudged, since his Labour will be so well recompensed; that if he has an Instrument well made, and takes due Care, he needs not fear being disappointed in his *Longitude* above 20 or 30 Miles, or thereabouts; and perhaps much less: But he will find the *Calculation* much easier, than he may suspect, by often repeated *Operations*, since every one of the foregoing Proportions, will be always the same, at what Time or in what Place soever he is to use them. The only Difficulty will be, to have a true clear Notion, how the *Ecliptic* and *Moon's Orbit* are posited, with respect to the *Equinoctial*, and to one another, and whether the *Angles* be acute or obtuse, at the Time of *Observation*. But Time and Practice will render all these Things easy.

I have only a Caution or two to give him before I conclude: I must advise him, in order to find the true *Altitude* of the *Sun* or *Moon's Center*, to take the Height of both their *Limbs*, as he is before directed. For tho' I have given the usual Table of their Apparent *Diameters*, as *Astrono-*

mers have determin'd them by the *Micrometer*, yet I am fully assured, from often repeated *Observations* made by both the above-mention'd *Instruments*, which have exactly agreed, that their apparent *Diameters* are considerably greater than they are put in the *Table*, even by several *Minutes*; concerning which I may perhaps take Occasion to say more some other Opportunity: In the mean Time, tho' this be very material in calculating the Measure of *Eclipses*, yet, by this Caution, the *Longitude* will not be affected by it.

Another Thing may be of great Service to the *Mariner*, if he please to remember it; namely, as often as is possible, to take his *Observations* when the *Moon* is near her *Apogee* or *Perigee*, because then a small Mistake in the *Moon's Excentricity* will make but a small Error in the 4th

| M. An. |    | Diff. |    |
|--------|----|-------|----|
| S.     | D. | M.    | S. |
| 0      | 2  | 0     | 6  |
| 0      | 5  | 0     | 16 |
| 0      | 10 | 0     | 32 |
| 0      | 15 | 0     | 48 |
| 0      | 20 | 1     | 04 |
| 0      | 25 | 1     | 20 |
| 1      | 00 | 1     | 34 |
| 1      | 05 | 1     | 48 |
| 1      | 10 | 2     | 02 |
| 1      | 15 | 2     | 16 |
| 1      | 20 | 2     | 28 |
| 1      | 25 | 2     | 38 |
| 2      | 00 | 2     | 48 |
| 2      | 05 | 2     | 58 |
| 2      | 10 | 3     | 06 |
| 2      | 15 | 3     | 12 |
| 2      | 20 | 3     | 18 |
| 2      | 25 | 3     | 24 |
| 3      | 00 | 3     | 26 |

*Equation*, in Comparison of what it will make, when the mean *Anomaly* is near 90 or 270 *Deg.* that is to say, near 3 or 9 *Signs*. For Example; suppose the *Excentricity* were 52000, and the *Moon's* mean *Anomaly* were but 2 *Degrees*; the 4th *Equation* would be 11 min. 52 sec. and if the *Excentricity* were 52500, it would be 11 min. 58 sec. where the Difference of 500 in the *Excentricity* makes a Difference in the *Equation* of no more than 6 sec. But if the mean *Anomaly* be 3 or 9 *Signs*, that is to say, if the *Moon* were 90 *Degrees* removed from either *Apogee* or *Perigee*, in the former Case, the *Equation* would be 5, 57, 12, and in the latter 6, 00, 38, where the Difference amounts to 3 min. and 26 sec. And whether the *Excentricity* be great or little, the Difference of 500 makes nearly the same Differences in the 4th *Equation*, as in the adjoining Table, by which (tho' otherwise of no great Service, yet) the Reader may see the Occasion of this Second Caution. For in this 4th *Equation*, being by much the greatest and therefore the most considerable, there is the greatest Danger of Mistakes; and for this Reason I hope it will be remembered.



I have now gone through this long and laborious, tho' perhaps seemingly short and easy Work, which I hope may be serviceable and acceptable to the Nation; and particularly, (if duly recommended) To **HIS ROYAL HIGHNESS**, to whom it is most submitively, and therefore it is hoped not undutifully dedicated. I must crave Leave once more to address my self to those Honourable and Learned **JUDGES**, whom the wise **LEGISLATURE** of **GREAT BRITAIN** have entrusted with the Determination of this very Important Affair. **THEIR HONOURS** may be pleased to take into Consideration the Pains I have taken, and how I have accomplish'd all the Parts of this Work by my own sole Industry, only where I have been beholden to the Great **SIR ISAAC NEWTON**, to whose Illustrious Memory I presume I have done no Injury, by endeavouring to set Him right, where He has been abused by the Errors of the Press. I have Reason to hope, (such is their Honour, Justice, and Impartialty,) that they will not suffer any other Person, to reap any Share of the Profit or Reputation, which they will find my Labours have deserved, as was the hard Fate of one of my Name, to whose Correction of Errors, and great Improvement of Sailing, the World is chiefly indebted, tho' another has most abusively gone away with the Name and Reputation of it.

Let me add a Word or two of Advice to the *Navigators* of *Great Britain*, and I have done. In the first Place, may they not be discouraged from making use of the Methods prescribed to them in these Sheets, by the seeming Difficulties and Tedioufness of the *Calculations*, since they will, after a little Practice, experience the Thing to be far otherwise; and more especially, since it is not possible (unless a sufficient *Automaton* could be found out, which might truly and constantly measure Time,) to render the Practice of this most useful Discovery more expeditious and easy, than they have it here fully explain'd. Again, may they not reject what is here deliver'd, or make it the Subject of Ridicule, from any Prejudices they may have entertain'd of the Impossibility of

of discovering the *Longitude* at Sea, upon no other Grounds, than because so many Attempts have hitherto proved unsuccessful: But rather let them take into Consideration what the great and learned Royal Astronomer Dr. *Edmund Halley* hath said concerning this Method I have here used, by the *Moon's* Motions, as they may find it in the 4th Page of this Book. Therefore I hope that relying on the Judgment of so great a Man, they will not turn their Backs upon this Method, than which in all Probability, a better will never be discover'd. I shall now conclude this Discourse, wishing them safe Voyages and rich Returns, Health and Prosperity, Peace and Plenty in all HIS MAJESTY's Dominions, and especially in this our Island of *Great Britain*.

*SOLI DEO GLORIA.*





*The READER may be pleased to correct the following  
ERRATA before he peruses the Book.*

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*In the INTRODUCTION Page 8, Line 28, see Page 86, Line 9.*

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